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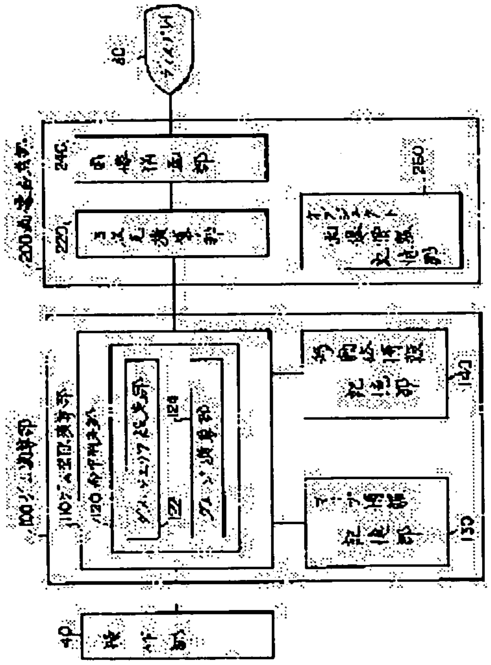
(54) THREE-DIMENSIONAL GAME MACHINE

(57)Abstract:
PURPOSE: To perform damage presentation full of variety by a hit state with simple calculation in judgement for collision or hit performed in a virtual three- dimensional game space.
CONSTITUTION: This game machine is a three-dimensional game machine in which a target appearing in a three-dimensional space is attacked based on an input signal and a prescribed game program from an operating part 40 and the game screen of the virtual three-dimensional space is displayed on a display. A game arithmetic part 100 includes a damage area setting part 122 which regulates damage quantity of different ranks for the target setting the coordinate position of the target in the virtual three-dimensional space as reference, and a damage calculation part 124 which calculates damage on the target based on in which rank of damage area an attack position for the target is included.



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CLAIMS

[Claim(s)]
[Claim 1] The actuation means for games which a player operates, and a game operation means to perform the game operation which appears in three-dimension game space and which attacks by receiving in label based on the input signal and the predetermined game program from said actuation means, In the three-dimension game equipment which displays the game screen of an implication and said virtual three-dimension game space on a display said game operation means It is based on said label coordinate location in said virtual three-dimension game space. A damage area setting means to set up two or more damage area which specifies said amount of damages of a rank which receives in label and is different, Three-dimension game equipment with which said attack location which receives in label is characterized by performing game production based on the label-amount of damages including a damage operation means to calculate said label damage to receive, based on whether it is contained in said damage area of which rank.
[Claim 2] In claim 1 said actuation means for games It is formed so that the item for an attack may be discharged towards the target which appears in game space including the trigger actuation means for predetermined attack item discharge. Said damage operation means Three-dimension game equipment characterized by forming the attack location which receives like a label of said item for an attack based on whether it is contained in said damage area of which rank so that said label damage to receive may be calculated.
[Claim 3] Said damage operation means is three-dimension game equipment characterized by being formed so that said label damage to receive may be calculated based on whether the moving trucking of said item for an attack passes through said damage area of which rank in claim 2.
[Claim 4] Based on to said damage area of which rank the effect area at the time of explosion of said item for an attack attains said damage operation means in either of claims 2 and 3, it is three-dimension game equipment with which it is characterized by being formed so that said label damage to receive may be calculated.
[Claim 5] Said damage area setting means is three-dimension game equipment characterized by said thing [having set up two or more damage area of a rank] so that the endocyst of the damage area where the amount of damages is big is carried out to the small damage area of the amount of damages, it approaches in either of claims 1-4 in a label criteria location and the amount of damages may become large.
[Claim 6] For said attack location which receives in label, said damage operation means is three-dimension game equipment with which it is characterized by judging whether it is contained in said damage area of which rank sequentially from a rank with the amount of damages small in claim 5.
[Claim 7] It is three-dimension game equipment characterized by said damage area setting means setting said each damage area as a rectangular parallelepiped configuration in either of claims 1-6.
[Claim 8] It is three-dimension game equipment characterized by said damage area setting means setting up said each damage area in the shape of a globular form in either of claims 1-6.

[Claim 9] Said game operation means is three−dimension game equipment characterized by the migration target which a player mobile moves in either of claims 2−8 in the inside of three−dimension game space based on the input signal from said actuation means for games, and appears in game space from a player mobile based on the actuation signal from said trigger actuation means, or to be formed so that it may turn in quiescence label and the item for an attack may be discharged.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] This invention relates to the three-dimension game equipment which appears in three-dimension game space and which attacks by receiving in label and enjoys a game, looking at the game screen of the virtual three-dimension game space displayed on a display.
[0002]
[Description of the Prior Art] Looking at the game screen displayed on a display conventionally, in virtual three-dimension game space, a player controls player mobiles, such as a fighter, and the shooting game equipment which attacks targets, such as an enemy fighter, is known.
[0003] If the cartridge with which the player shot this three-dimension game equipment hits the predetermined hit area set up by corresponding in label, the screen where a target receives a damage will be displayed and a score will be added to a player.
[0004]
[Problem(s) to be Solved by the Invention] How the hit judging (henceforth hit checking) with the cartridge and targets, such as an enemy fighter, with whom the player shot this kind of game equipment is performed, and how the damage given to a partner according to hit condition is directed become the important factor which influences the fun of a game. in rough hit checking, in where, if cartridge-ed production is the same, the fun of a game will be halved.
[0005] However, wherever it may label-hit, conventional three-dimension game equipment is a setup to which a fixed damage is given, and it is not constituted so that the damages which a partner receives by the hitting location may differ. For this reason, cartridge-ed production which is different where the cartridge hit is not made.
[0006] Although it becomes what has a very high reality for a player in respect of this by battle in three-dimension space especially in order to deliver an attack from various directions while an enemy and the fighter of an ally carry out three-dimension migration like actual air warfare Since actuation of a player was not reflected in cartridge-ed production by the detail but only very rough cartridge-ed production was made, this became a cause, the reality of a game was spoiled and there was a problem of reducing the fun of game production.
[0007] This invention is made in view of such a technical problem, and the purpose is in providing damage production with the three-dimension game equipment in which the interesting high game of a reality is possible at a detail reflecting actuation of a player in the game which appears in three-dimension game space and which attacks by receiving in label.
[0008]
[Means for Solving the Problem and its Function] In order to attain said purpose, invention of claim 1 The actuation means for games which a player operates, and a game operation means to perform the game operation which appears in three-dimension game space and which attacks by receiving in label based on the input signal and the predetermined game program from said actuation means, In the three-dimension game equipment which displays the game screen of an implication and said virtual three-dimension game space on a display said game operation means It is based on said label coordinate location in said virtual three-dimension game space. A

damage area setting means to set up two or more damage area which specifies said amount of damages of a rank which receives in label and is different, Said attack location which receives in label is characterized by performing game production based on the label-amount of damages including a damage operation means to calculate said label damage to receive, based on whether it is contained in said damage area of which rank.
[0009] In order that a target may determine the magnitude of the damage received by attack according to invention of claim 1, a damage area setting means Received in label on the basis of the label coordinate location in virtual three-dimension space, and two or more damage area which specifies the amount of damages of a different rank is set up. The label damage to receive is calculated based on whether the attack location which receives in [a damage operation means] label is included in the damage area of which rank.
[0010] Therefore, the production of the target which had the volume in virtual three-dimension space according to this invention from which the magnitude of the damage to receive differs by whether the attack was received in which the location is attained, and he can offer the game equipment which can perform game production which was more rich in the reality.
[0011] In order to attain said purpose, invention of claim 2 In claim 1 said actuation means for games It is formed so that the item for an attack may be discharged towards the target which appears in game space including the trigger actuation means for predetermined attack item discharge. Said damage operation means The attack location which receives like a label of said item for an attack is characterized by being formed based on whether it is contained in said damage area of which rank, so that said label damage to receive may be calculated.
[0012] According to invention of claim 2, a damage operation means detects whether it is contained in the damage area of which label rank of the attack location calculated based on the input of the trigger actuation means of a player, and is calculating the label amount of damages to receive.
[0013] Therefore, according to this invention, it becomes possible to change the production of the damage given in label with the label attack location to receive, and the game equipment which can perform game production which was more rich in the reality can be offered.
[0014] In order to attain said purpose, invention of claim 3 is characterized by forming said damage operation means so that said label damage to receive may be calculated based on whether the moving trucking of said item for an attack passes through said damage area of which rank in claim 2.
[0015] According to invention of claim 3, a damage operation means detects whether the ballistic trajectory calculated based on the input of the trigger actuation means of a player passes through the damage area of which label rank, and is calculating the label amount of damages to receive.
[0016] Therefore, it becomes possible to change the production of the damage given in label by which label location the cartridge hit, and the game equipment which can perform game production which was more rich in the reality can be offered.
[0017] Moreover, invention of claim 4 is characterized by being formed based on to said damage area of which rank the effect area at the time of explosion of said item for an attack attains said damage operation means, so that said label damage to receive may be calculated in either of claims 2 and 3.
[0018] According to invention of claim 4, a damage operation means detects to the damage area of which label rank the area where the explosion on the moving trucking of the item for an attack does damage reaches, and the label amount of damages to receive is calculated.
[0019] Therefore, when the item for an attack explodes, a target becomes possible [changing the production of the damage given in label by in which location it was], and can offer the game equipment which can perform game production which was more rich in the reality.
[0020] Moreover, in either of claims 1-4, as for invention of claim 5, said damage area setting means is characterized by said thing [having set up two or more damage area of a rank] in it so that the endocyst of the damage area where the amount of damages is big is carried out to the small damage area of the amount of damages, it approaches it in a label criteria location, and the amount of damages may become large.

[0021] By establishing a criteria location in a label-core according to invention of claim 5, when it suffers damage in the place near a core, and a serious damage is received and it suffers damage in a label-edge, production which receives a small damage is attained.

[0022] Moreover, the degree of a damage is changeable whether in the case of the collision judgement of said mobile, said cartridge and other mobiles, or a body, it grazed whether it collided directly.

[0023] Moreover, invention of claim 6 is characterized by said damage operation means judging whether said attack location which receives in label is included sequentially from the small rank of the amount of damages in said damage area of which rank in claim 5.

[0024] When damage area is set up like claim 5, the endocyst of the damage area where the amount of damages is big is carried out to the damage area where the amount of damages is small. Therefore, the count of decision increases and the amount of operations also increases as a damage will become large, if it judges whether an attack location is included sequentially from outside damage area. If it does in this way, when the amount of damages is small, there can be few amounts of operations, and it can end, and can judge by the useless operation which is not.

[0025] Moreover, invention of claim 7 is characterized by said damage area setting means setting said each damage area as a rectangular parallelepiped configuration in either of claims 1-6.

[0026] If a damage area setting means sets up each damage area like invention of claim 7, a damage area judging means will judge the amount of damages by detecting whether the coordinate showing the attack location in virtual three-dimension space, a hit location, or the effect area at the time of explosion is included in the damage area of each rank of a rectangular parallelepiped configuration. Therefore, if the core of the damage area of each rank of this rectangular parallelepiped configuration is set as a label hit alignment, the operation for the judgment which a damage area judging means performs can perform a damage judging in the amount of operations only with few degree operations of a coordinate.

[0027] Moreover, invention of claim 8 is characterized by said damage area setting means setting up said each damage area in the shape of a globular form in either of claims 1-6.

[0028] If a damage area setting means sets up each damage area like invention of claim 8, a damage area judging means will judge the amount of damages by detecting whether the coordinate showing the attack location in virtual three-dimension space, a hit location, or the effect area at the time of explosion is included in the damage area of each globular form rank. Therefore, if the core of the damage area of each of this globular form rank is set as a label hit alignment, the damage judging reflecting the distance from a target core can be performed.

[0029] In either of claims 2-8, said game operation means is characterized by the migration target by whom a player mobile moves and appears the inside of three-dimension game space in game space from a player mobile based on the actuation signal from said trigger actuation means, or to be formed so that it may turn in quiescence label and the item for an attack may be discharged by invention of claim 9 based on the input signal from said actuation means for games.

[0030] According to invention of claim 9, an enemy can be attacked moving in the inside of virtual three-dimension space, when a player operates the actuation means for games, and the game equipment which performs game production which inflicts the damage according to the attack on an enemy can be offered.

[0031]

[Example] Next, the suitable example of this invention is explained to a detail based on a drawing.

[0032] A suitable example of the business-use video game equipment with which this invention was applied is shown in drawing 1 . The video game equipment of an example has the cockpit section 10 and the display 30 arranged ahead [the].

[0033] Said cockpit section 10 is formed supposing the cockpit of a fighter. If the player which sat on the sheet 12 throws in predetermined coin from the coin injection section 18 and a start button 20 is operated, a game will start and the game screen 300 will be displayed on a display 30. The scene which is in sight at the front of the cockpit section 10 in the three-dimension game space beforehand set up so that it might mention later is displayed on this game screen

300. An enemy's fighter 532 is flying in this three-dimension game space. In addition, since it is easy to operate the way of the image which is visible to a beginner, the scene seen from the back slant of a self-opportunity may be made to be displayed.

[0034] As shown in drawing 2 , the operation lever 14 and the speed lever 16 are formed in this cockpit section 10 as a controlling gear. By pushing down forward and backward, said operation lever 14 controls a fighter to the bottom or facing up (the direction of the y-axis), and controls it by pushing down on a longitudinal direction to circle in a fighter the right or leftward (the direction of a x axis). Furthermore, the speed lever 16 controls the speed to front (the direction of the z-axis) by operating this. a player — the operation lever 14 — operating it — the posture of its own fighter — and it is suitable, it controls, the speed lever 16 is operated, its speed is controlled, an enemy's fighter 532 is pursued or a terrestrial enemy base is discovered. and it is alike like labels, such as the enemy fighter 532 which appears on the game screen 300, and an enemy base, collimation 320 is doubled, the trigger carbon buttons 22 and 24 are operated, a machine gun and a missile are launched, a target is defeated, and a score is got.

[0035] The functional block diagram of the business-use video game equipment of an example is shown in drawing 3 .

[0036] The business-use video game equipment of an example includes the player control unit 40, the game operation part 100, the image composition section 200, and a display 30.

[0037] Said player control unit 40 is a member which the player of the various levers 14 and 16 shown in drawing 2 and manual operation buttons 20 and 22, and 24 grades operates. The actuation signal is inputted into the game operation part 100.

[0038] Based on the game program beforehand determined as the input signal from a control unit 40, the game operation part 100 performs various kinds of game operations, outputs data required for image composition to the image composition section 200, and is constituted including the game space operation part 110, the map information storage section 130, and the mobile information storage section 140.

[0039] There are what moves [fighter], and a thing of immobilization of the location of the ground, a crest, an enemy base, a river, etc. in the object which constitutes three-dimension space.

[0040] The object number of the object which expresses the image of the enemy fighter which should be displayed on the positional information, the direction information, and these locations of a mobile, such as an enemy fighter, to the mobile information storage section 140 is memorized (this location, direction information, and object number that were memorized are hereafter called mobile information).

[0041] Moreover, the map information which consists of the ground, a crest, an enemy base, a river, etc. is divided into the map information storage section 130 in the shape of a rectangle, and the object number of the object showing the image of the ground, the crest, etc. which should be displayed on the positional information and this location of this divided map is memorized (this positional information and object number that were memorized are hereafter called division map information).

[0042] The predetermined game program is memorized by the storage section (not shown) prepared in the game space operation part 110. The game space operation part 110 calculates the position coordinate of a self-opportunity fighter according to the self-opportunity fighter information read from the actuation signal and the mobile information storage section 140 from this game program and a control unit 40. Furthermore, the game space operation part 110 also calculates the position coordinate of other mobiles based on the mobile information read from a game program and the mobile information storage section 140. And game space is set up based on the division map information read from the position coordinate of a self-opportunity fighter, the position coordinate of other mobiles, and the map information storage section 130.

[0043] Thus, in this example, a fighter moves by operation of a player in the inside of the predetermined three-dimension game space set up as shown in drawing 4 (A), signs that a player attacks an enemy's fighter are calculated, and the result of an operation is outputted to the image composition section 200.

[0044] Since an image is supplied to a display every [1/] 60 seconds with the game equipment of this example, the game space operation part 110 calculates the position coordinate in the world coordinate of each mobile every [1/] 60 seconds, and is outputting it to the image composition section 200.

[0045] In addition, the detail of data processing which can set this game space operation part 110 hit judging section 120 is mentioned later.

[0046] The image composition section 200 forms the false three-dimension image which actually appears from a player according to the result of an operation of the game operation part 100, displays it on a display 30, and is constituted including the three-dimension operation part 220, the image drawing section 240, and the object image information storage section 260.

[0047] The image information of mobiles, such as an enemy fighter specified by the aforementioned object number, and image information, such as the ground, a crest, and an enemy base, are memorized by said object image information storage section 260.

[0048] In this case, such image information is expressed as a set of two or more polygons. For example, as shown in drawing 5 , the mobile objects 510, such as an enemy fighter, are a polygon 512-1,512-2 and -512-5. — It is expressed by the set. And the image information of this polygon 512-1 - 512-5 — which consists of each top-most-vertices coordinate etc. is memorized by the object image information storage section 260. Similarly, map information, such as an enemy base which is a map object, is also expressed as a set of a polygon, and the image information which consists of a top-most-vertices coordinate of this polygon etc. is also memorized by the object image information storage section 260.

[0049] The three-dimension operation part 220 reads the image information which corresponds from the object image information storage section 260 based on the inputted data (mobile information and division map information), and sets it to game space as a set of two or more polygons. From the positional information of each object inputted by the world coordinate at this time, processing which searches for the top-most-vertices coordinate in the view system of coordinates of a set of the polygon which constitutes each object is performed. That is, since the output coordinate of game space operation part is a world coordinate, it performs coordinate transformation to view system of coordinates. And clipping processing which removes the data out of a visual field, perspective-projection conversion in a screen coordinate system, sorting processing, etc. are processed, and the data after processing are outputted to the image drawing section 240.

[0050] In the image drawing section 240, image information which should actually be visible from a player is formed from these inputted data. That is, since the data inputted from the three-dimension operation part 220 are expressed as image information which consists of top-most-vertices information on a polygon etc., in the image drawing section 240, formation of the image information in all the dot inside a polygon is performed from the top-most-vertices information on this polygon etc. And the data after processing will be outputted to a display 30, and a virtual three-dimension image as shown in drawing 4 (B) will be formed.

[0051] In addition, as the operation technique of the image composition in the image drawing section 240, it may ask for the border line of a polygon from the top-most-vertices coordinate of a polygon, and may ask for the profile point pair which is the intersection of this border line and scanning line, and the technique of making Rhine formed of this profile point pair correspond to predetermined color data etc. may be used. Moreover, ROM etc. may be made to memorize beforehand the image information of all the dots in each polygon as texture information, and the technique called texture mapping of read and sticking this may be used by making into the address the texture coordinate which each top-most vertices of a polygon were given.

[0052] The principle Fig. of the image composition technique is shown in drawing 6 .

[0053] The information about the three-dimension object 510 which appears at the game equipment of an example in the map information in the three-dimension game space 500 and this three-dimension game space 500 is beforehand memorized by the map information storage section 130 and the mobile information storage section 140 in the game operation part 100.

[0054] Moreover, the image information about said three-dimension object 510 is expressed as a geometric model which consists of two or more polygons 512-1,512-2,512-3 and ...., and is beforehand memorized by the object image information storage section 260.

[0055] If the fighter game of this example is taken for an example, the three-dimension object 510 is fighter 532 grade which appears in the three-dimension game space 500, and various kinds of three-dimension objects which, in addition to this, express the background of the ground 519, a crest 520, a building 522, a position 524, etc. as shown in drawing 4 are arranged in the three-dimension game space 500.

[0056] Perspective-projection conversion is carried out in the image composition section 200 on the perspective-projection side 620 of view system of coordinates centering on the view 610 of the virtual player P, and these three-dimension objects are displayed on a display 30 as a false three-dimension image 522.

[0057] The physical relationship of the fighter 530 which the player in the three-dimension game space 500 controls, and an enemy's fighter 532 is shown in drawing 7 . Although the three-dimension game space 500 is expressed with a world coordinate (XW, YW, and ZW) in principle, it is expressed with the view system of coordinates which set the view 610 shown in drawing 6 as the location of the cockpit of the fighter 530 which a player controls in this drawing. The direction of the look of a view 610 is defined as the z-axis, they define a x axis and the vertical direction for a longitudinal direction as the y-axis, and these view system of coordinates move with migration of the self-opportunity 530. Therefore, if a player makes it a front [control unit / 40] and looks at a display 30 from a view 610, he can sit on the cockpit of a fighter and an image which is located in the three-dimension game space 500 can be seen.

[0058] When a player operates control-lever 14 grade and rotation of the fighter by which he has ridden virtually, advancing side by side, etc. are operated, the location of the view 610 over the three-dimension game space 500 will change, and the three-dimension game space 500 will rotate and advance side by side. For this reason, the game operation part 100 calculates rotation of the three-dimension object 510 which constitutes the three-dimension game space 500 based on this actuation signal and a game program and which is a fighter, or other three-dimension objects, advancing side by side, etc. on real time. And in the image composition section 200, perspective-projection conversion is carried out on the perspective-projection side 620, and these three-dimensions object is displayed on a display 30 as a false three-dimension image 522 which changes on real time.

[0059] When the technique of computer graphics is used, said three-dimension object 510 is creating the geometric model using independent body system of coordinates. That is, each polygon which constitutes the three-dimension object 510 is arranged on these body system of coordinates, and that geometric model is specified.

[0060] Furthermore, the three-dimension game space 500 is constituted using a world coordinate (XW, YW, and ZW), and the three-dimension object 510 expressed using body system of coordinates is arranged in a world coordinate according to the movement model.

[0061] And by making the location of a view 610 into a zero, data are changed into the view system of coordinates which took the direction of a look in the forward direction of the z-axis, and perspective-projection conversion of each coordinate is carried out to the screen coordinate system which is plane of projection 620. Thus, the image within the visual field of the three-dimension game space 500 which is visible from a view 610 can be displayed on a display 30. Therefore, a player can carry out the virtual simulation of the condition of attacking the hostile aircraft, by operating levers 14 and 16 and trigger buttons 22 and 24, controlling a fighter for the inside of the three-dimension game space 500.

[0062] In the business-use game equipment of an example, if a game is started, the fighter which a player controls will fly about the virtual three-dimension game space 500 shown in drawing 4 freely, and will attack a hostile aircraft, an enemy base, etc. by the vulcan cannon or the missile.

[0063] Drawing 8 expresses the three-dimension game space 500 as x of view system of coordinates, and two-dimensional space of z. In this drawing, 560 is the field-of-view range of the fighter which a player controls, and, as for a **** range of visibility and 562, 564 is [the Balkan Peninsula effective range distance and 566] the missile maximum ranges.

[0064] Therefore, even if it discharges a missile and a vulcan cannon towards the enemy fighter which is not contained in the missile maximum range 566 and the Balkan Peninsula effective range distance 562, an attack cannot do an enemy fighter effectively.

[0065] A more detailed example of the game screen displayed on a display 30 is shown in drawing 9 . Only when the enemy fighter 532 is located in the field-of-view range 560 in the three-dimension game space 500 and the location is moreover located to the front than the **** range of visibility 564 shown in drawing 8 , the game equipment of an example is formed so that the image of the enemy fighter 532 may be displayed on a game screen. And target DISHIGUNETA 310a is displayed on the display position of the enemy fighter 532 in piles. This target DISHIGUNETA 310a shows the location of the enemy fighter 532, and the enemy fighter 532 is located at the core of that circle. Therefore, a player can check easily the enemy fighter 532 which exists in the game screen 300 by this target DISHIGUNETA 310a.

[0066] Furthermore, if the enemy fighter 532 enters in the missile range circle 324, the missile seeker 322 will be displayed automatically and will start migration towards the enemy fighter 532. And if this missile seeker 322 laps with target DISHIGUNETA 310a, a missile will be in the condition that lock on was carried out at the enemy fighter 532. In this condition, if a player operates the trigger carbon button 24 for a missile launch, as shown in drawing 11 , a missile 582 will be launched, and tailing to the enemy fighter 532 will be started. Usually, although this missile 582 will track the enemy fighter 532 automatically and the enemy fighter 532 will be hit, as the game operation part 100 detects this missile launch and a case is shown in drawing 11 , game production which emits a chaff 312 from the enemy fighter 532 may be performed.

[0067] Whether a missile 582 is disturbed by this chaff 312 depends for this probability on game level further according to a probability. When disturbed, a missile 582 carries out sequential tailing, as shown in drawing 11 (A), (B), and (C) for the purpose of a chaff 312, and explodes on the point of a chaff 312.

[0068] Moreover, if the enemy fighter 532 is located within the limits of the Balkan Peninsula effective range distance 562 shown in drawing 8 , as shown in drawing 9 , the vulcan-cannon collimation 320 will be displayed in the center of the game screen 300. By doubling collimation with the enemy fighter 532 using this vulcan-cannon collimation 320, and operating the trigger carbon button 22 for vulcan cannons, as shown in drawing 10 , a vulcan cannon can be discharged towards the enemy fighter 532, and this can be shot down.

[0069] In addition, ******** of the item 350 for an attack to hold is performed in the radar 340 which displays the location of the enemy fighter 532 on the left corner of this game screen 300, and a lower right corner, and the game residual time 330 is displayed on an upper right corner.

[0070] Moreover, in order to perform said vulcan cannon and hit judging actuation of a missile to the game equipment of this example, the hit judging section 120 is formed in the game space operation part 110.

[0071] This hit judging section 120 compares the cartridge 580 of a vulcan cannon discharged from the fighter 530 of a player, and the location P2 of a missile 582 with the location P1 of the enemy fighter 532 which is a target, and it is constituted so that that hit judging may be performed.

[0072] And if a vulcan cannon and a missile hit an enemy, it is constituted so that explosion etc. may be directed visually and in acoustic sense.

[0073] by the way, in this kind of game, how hit-checking actuation with the cartridge and target which the player shot is performed, and how the damage given to a partner according to hit condition is directed influence the fun of a game — it comes size and becomes 7s factors. The fun of a game will be halved in rough hit checking.

[0074] For this reason, the hit judging section 120 of an example is constituted on the basis of the coordinate location P1 of the enemy in three-dimension game space 500 so that the damage area setting section 122 which sets up two or more damage area which specifies said amount of damages of a rank which receives in label and is different, and the damage operation part 124 which calculate the damage which can set in label based on whether said attack location which receives in label is included in the damage area of which rank may contain.

[0075] The example of damage area over the enemy fighter 532 is shown in drawing 12 (A). In the example, two or more cubes centering on an airframe core are set up as second hit-checking box 700,710 for a start as said damage area, and it is formed so that a damage judging may be performed. In here, the second hit-checking box 710 is small, and the first hit-checking box 700 is formed greatly, and the second hit-checking box 710 is set up so that endocyst may be carried out to the first hit-checking box 700. In addition, the first hit-checking box 700 is set up more greatly than the size of the actual enemy fighter 532, in order to make shooting easy. And to the second hit-checking box 710 located in a core side, the big amount of damages is set up and the small amount of damages is relatively set to the first hit-checking box 700 located outside.

[0076] Thus, the damage area setting section 122 of an example is performing a rank setup of each of said hit-checking box 700,710 so that the endocyst of the hit-checking box 710 where the amount of damages is big is carried out, it approaches the hit-checking box 700 where the amount of damages is small in the center position P1 of the enemy fighter 532 which is a target, and the amount of damages may become large.

[0077] Moreover, based on whether the attack location to the enemy fighter 532 which is the target of the item for an attack is included in the hit-checking box of which rank, said damage operation part 124 is formed so that the damage of the enemy fighter 532 which is a target may be calculated. In this example, the damage judgings differ a little by the case where a vulcan cannon is used as an item for an attack, and the case where a missile is used.

[0078] In drawing 12 (B), the damage judging actuation at the time of using a vulcan cannon is shown, and the damage judging actuation at the time of using a missile is shown in this drawing (C) at it.

[0079] First, the damage judging actuation at the time of using a vulcan cannon is explained. The hit-checking boxes 700 and 710 of the enemy fighter (not shown) which receives an attack by the vulcan cannon are shown in drawing 12 (B). A player discharges a vulcan cannon towards an enemy fighter (not shown), and the locus of the projectile 580 assumes the case where it moves in order of 580-1,580-2--580-3 as shown in this drawing. At this time, said damage operation part 124 calculates the damage in the enemy fighter 532 which is a target based on whether the moving trucking of a projectile 580 passes through the hit-checking box of which rank. For example, when the moving trucking of a projectile 580 passes neither of each hit-checking box 700,710, it is judged that the projectile separated and the operation of a damage is not performed.

[0080] Moreover, if the moving trucking of a projectile 580 passes through the first hit-checking box 700, the damage operation part 124 will judge whether the locus of a projectile passes through the second hit-checking box 710 next. When it is judged that it does not pass through the second hit-checking box 710, it judges that it passed only through the first hit-checking box 700, and an operation setup of the small amount of damages is performed. When [which passes through the second hit-checking box 710] judged, from that of the airframe of the enemy fighter 532, it is judged that the part near a core was hit and an operation setup of the big amount of damages is performed.

[0081] Moreover, also when a missile 582 is launched towards the enemy fighter 532, as for said damage operation part 124, a damage operation as well as [as a principle] hit-checking actuation of a vulcan cannon is performed. That is, if said missile 582 hits the enemy fighter 532, a game operation will be performed so that it may explode in a hit location. And an operation setup of the amount of damages from which the explosion differs based on to any of a hit-checking box it shall belong between said first and the second is performed.

[0082] Moreover, the concept of an explosion radius is also set to said missile 82. For example, as shown in drawing 11 , the enemy fighter 532 drops a chaff 312, and when a missile collides with this chaff 312 and explodes, an explosion location will be included in both [of the hit-checking box 700,710] the first and the second.

[0083] Even in this case, from this explosion location, it is judged whether either of the second hit-checking box 700,710 exists for a start in the radius of r, and an operation setup of the amount of damages is performed.

[0084] In addition, when a vulcan cannon and a missile hit the hit-checking box same with a natural thing, compared with a vulcan cannon, the damage in the direction of a missile is serious, and is set up. Moreover, as shown in drawing 12 (C), when it explodes outside a hit-checking box compared with the case where a missile 582 explodes in said hit-checking box even when the

same missile explodes, it cannot be overemphasized that the amount of damages is set up small.
[0085] And the game space operation part 110 of an example will direct cartridges-ed, such as large and small explosion and emitting smoke, visually and in acoustic sense, if a missile and a vulcan cannon hit an enemy.
[0086] Moreover, the enemy fighter 532 has the strength determined in the magnitude of the damage received before, and it has declined in the strength, so that the damage received before is serious. Therefore, as the hostile aircraft in which carried out the cartridge-ed once and the strength declined, and the enemy who has not done a cartridge-ed yet, cartridge-ed production which is different even when the same cartridge-ed as a degree is received will be performed, and the game screen where a reality is more high will be displayed.
[0087] Drawing 14 is the game screen which displayed the appearance of the cartridge-ed of a hostile aircraft. Sequentially from this drawing (A), the production screen at the time of receiving a serious damage is shown according to this drawing (E).
[0088] If a hostile aircraft can give a damage by the missile and the Balkan Peninsula, production of the cartridge-ed according to the amount of damages will be performed. The engine performance falls according to the amount of damages, and, as for the enemy who did the cartridge-ed, rotation etc. becomes slow.
[0089] when there are few amounts of damages, it is shown in this drawing (A) — as — the smoke of a white system — little **** — production [like] is performed. An increment of a damage makes production which a fire generates, as shown in this drawing (B).
[0090] Production of explosion is performed while being shown in the small explosion and this drawing (D) showing in this drawing (C) in the place where the damage exceeded the constant rate. Although smallness and inside explosion take place at random fundamentally, the probability is changed according to the situation of the strength of course selection, a stage, residual time, and an enemy etc.
[0091] And if an enemy's strength becomes zero, the explosion screen shown in this drawing (E) will be displayed.
[0092] The flow chart of hit judging actuation of the equipment of an example and damage production actuation is shown in drawing 13 .
[0093] In addition, in order to simplify explanation, it explains taking the case of the case where hit checking of a vulcan cannon is performed here.
[0094] First, a player controls a fighter 530 and assumes the case where ****** and a vulcan cannon are discharged for the enemy fighter 532 to the vulcan-cannon collimation 320 neighborhood as shown in drawing 10 .
[0095] The relation between the three-dimension coordinate location P1 of the enemy fighter 532 at the time of making the player fighter 530 into the zero of view system of coordinates at this time and the three-dimension coordinate location P2 of the discharged cartridge 580 of a vulcan cannon is shown in drawing 7 .
[0096] The damage operation part 124 will detect whether it passed through the enemy fighter 532 hit-checking box 700,710 which this ballistic trajectory shows to drawing 12 (A) based on the present coordinate location P2 of the discharged cartridge 580, if it does in this way and a vulcan cannon is discharged.
[0097] As shown in drawing 12 (B), when a cartridge 580 is in the exterior of the first hit-checking box 700 like 580-1, a hit is not detected yet, but a hit is detected when a cartridge 580 comes to the interior of the second hit-checking box 700 like 580-2.
[0098] Hit checking of the first hit judging, and the call and the second hit-checking box 710 is called the second hit judging for hit checking with the first hit-checking box 700 below for explanation. Moreover, the first hit signal, the second hit signal, and a call and the output when separating are called the first blank signal and the second blank signal for the output when hitting to each.
[0099] In the first hit judging, hit-checking actuation is performed by comparing the difference of X of the coordinate P2 of a cartridge 580 expressed with the world coordinate, and the core of the hit-checking box 700, Y, and Z coordinate data with each reference value of the X coordinate for the first hit judging which was able to be defined beforehand, Y coordinate, and a

Z coordinate. Since the core of an airframe and the core of the first hit-checking box 700 are in agreement here, X of an enemy's fighter 532, Y, and Z coordinate data can be used as X of the core P1 of the first hit-checking box 700, Y, and Z coordinate data.

[0100] If one side of the P2 (X2, Y2, Z2) and first hit-checking box 700 is set to two a1 for the coordinate of P1 (X1, Y1, Z1) and a cartridge 580, the coordinate of the core of the first hit-checking box 700 The X coordinate, Y coordinate, and Z coordinate reference value for said first hit judging are set to a1, and the following relation is realized when the coordinate P2 of a cartridge 580 is in the interior of this first hit-checking box 700.

[0101]

| X2 - X1| <= a1 — (1)

| Y2 - Y1| <= a1 — (2)

| Z2 - Z1| <= a1 — (3)

Since the game screen is constituted so that a display may be supplied every [1/] 60 seconds, the game operation part 100 is calculating the value of the coordinates P1 (X1, Y1, Z1) and P2 (X2, Y2, Z2) in the world coordinate of a mobile every [1/] 60 seconds. a ******** [that, as for the damage operation part 124, the value will fill the relation of above-mentioned (1) - (3) about a cartridge and each object if a cartridge is discharged by trigger actuation] — checking — **** — the relation of above-mentioned (1) - (3) — when **** is all carried out, the first hit signal is outputted (step 10).

[0102] It is ********** about the above-mentioned hit-checking actuation every [1/] 60 seconds until the possibility of a hit disappears, when not filling. Existence of the possibility of a hit is performed by the physical relationship of the mobile in consideration of a future ballistic trajectory and migration, when partners are mobiles, such as an enemy fighter. That is, when a cartridge 580 comes to the location of 580-3 by drawing 12 (A), it is supposed that there is no possibility of a hit henceforth. Moreover, when it was not a mobile, the future ballistic trajectory separated from the partner and it calculates, it is supposed that there is no possibility of a hit. Thus, when there is no possibility of a hit, the first blank signal is outputted (step 10).

[0103] In addition, in the first hit judging, if the above-mentioned hit-checking actuation is performed only about the object which calculates a ballistic trajectory beforehand and has the possibility of a hit, the load of CPU will mitigate. And the first blank signal is outputted by the first hit judging, and if a ballistic trajectory is judged that there is no possibility of a collision in an enemy fighter (step 12), the usual game production will be performed (step 22).

[0104] Moreover, the first hit signal is outputted by the first hit judging, and if it is judged that the cartridge 580 has hit the hit-checking box 700 (step 12), the second hit judging of whether next a cartridge 580 hits the second hit-checking box 710 will be performed (step 14).

[0105] The second hit judging also gives the first hit judging and a principle target same hit-checking actuation. However, since the second hit judging confirms whether a cartridge 580 passes also through the second hit-checking box 710 in short time amount while a cartridge 580 passes through the first hit-checking box 700 as shown in drawing 12 (B), it is performed by repeating the above-mentioned hit-checking actuation in the cycle shorter than the first hit judging. That is, according to 1 [of a cartridge 580 and an enemy fighter] of 532 / coordinate value in every 60 seconds, and its movement condition, 1/60 second is divided into a still shorter cycle, and hit-checking actuation is performed in quest of each coordinate value.

[0106] If one side of P2 (X2, Y2, Z2) and the hit-checking box 710 is set to two a2 for the coordinate of P1 (X1, Y1, Z1) and the cartridge 580 for which carried out in this way and it asked, the coordinate of the core of the hit-checking boxes 700 and 710 The X coordinate, Y coordinate, and Z coordinate reference value for said second hit judging are set to a2, and the following relation is realized when the coordinate P2 of a cartridge 580 is in the interior of this second hit-checking box 710.

[0107] | X2 - X1| <= a2 -- (4)

| Y2 - Y1| <= a2 -- (5)

| Z2 - Z1| <= a2 -- (6)

And the damage operation part 124 is ********** about the above-mentioned hit-checking actuation until it outputs the second hit signal when all the relation of above-mentioned (4) - (6)

is filled, and the possibility of a hit disappears, when not filling. And if it judges that there is no possibility of a hit, the second blank signal will be outputted.

[0108] The second hit signal is outputted by the second hit judging, if judged with the cartridge 580 having hit the second hit-checking box 710 (step 16), large damage production (step 18) will be performed and a large damage production screen like drawing 14 (B) will be displayed.

[0109] If the second blank signal is outputted by the second hit judging and it is judged as a hit only in the first hit-checking box 700 (step 16), small damage production will be performed (step 20) and a small damage production screen like drawing 8 (A) will be displayed.

[0110] thus, the cartridge 580 — size — it is confirming whether it hit in which hit-checking boxes 700 and 710, when it hits in the hit-checking box 710, a serious damage is given to a partner, when it hits only in the hit-checking box 700, a small damage is given to a partner, and when other, the cartridge 580 does not give a damage noting that it has not hit the mark.

[0111] Thus, if the hit-checking boxes 700 and 710 are used as a cube, only by addition and subtraction and a size judging of a coordinate value, since hit checking is performed, the amount of data processing can be reduced sharply, and the burden of CPU can be mitigated. Moreover, although considered as the cube in this example, effectiveness is the same also as a rectangular parallelepiped.

[0112] Moreover, although the difficulty of shooting is decided by size of a hit-checking box, in this example, the hit-checking box 700 is set up more greatly than the size of the system for shooting difficulty relaxation. Therefore, it is become empty and lost that a game will be completed comparatively becoming easy for a beginner to hit the hit-checking box 700, and not hitting it at all. Moreover, since damage production changes with degrees of a hit, an upper person can enjoy the game in which its arm was reflected correctly.

[0113] Moreover, when it is a setup which can choose the difficulty of a game, it is made easy to take the larger hit-checking box of a hostile aircraft in for beginners, and to hit, it may be made hard to take the more smallish hit-checking box of a self-opportunity, and to hit, and in for upper persons, you may constitute so that it may become reversely [the].

[0114] Moreover, rotation which an operation load of rotate [although rotation of an airframe can be used for cubical rotation as it is since the hit-checking box centers on the airframe core / the hit-checking box itself] increases and which is united with an airframe posture in this example since the visual effectiveness on the appearance of a game is comparatively thin is not performed, but it is made the core coordinate of an airframe so much at immobilization.

[0115] In addition, this invention is not limited to said example and various kinds of deformation implementation is possible for it in the range of the summary of this invention.

[0116] Although said example explained taking the case of the case where each damage area is set up as a hit-checking box which carried out the cube configuration, this invention can be formed in various configurations not only this but if needed. Although especially this damage area is spatially set as the easy three-dimension configuration of an operation, it is desirable, for example, it is also possible to form in the shape of a globular form.

[0117] Moreover, in said each example, this setup was performed so that the endocyst of the damage area where the amount of damages is big might be carried out to the damage area where the amount of damages is small, but this invention may be arranged so that two or more damage area of not only this but a different rank may adjoin, and it may be set up so that that part may overlap again.

[0118] For example, the engine section may be used as another hit-checking box, or a production which used the vane as another hit-checking box, and is different may be made.

[0119]

[Effect of the Invention] As explained above, according to this invention, in the game which appears in three-dimension game space and which attacks by receiving in label, it is effective in the ability to provide damage production with the three-dimension game equipment in which the interesting high game of a reality is possible at a detail reflecting actuation of a player.

[0120]

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TECHNICAL FIELD

[Industrial Application] This invention relates to the three-dimension game equipment which appears in three-dimension game space and which attacks by receiving in label and enjoys a game, looking at the game screen of the virtual three-dimension game space displayed on a display.

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PRIOR ART

[Description of the Prior Art] Looking at the game screen displayed on a display conventionally, in virtual three-dimension game space, a player controls player mobiles, such as a fighter, and the shooting game equipment which attacks targets, such as an enemy fighter, is known.
[0003] If the cartridge with which the player shot this three-dimension game equipment hits the predetermined hit area set up by corresponding in label, the screen where a target receives a damage will be displayed and a score will be added to a player.

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EFFECT OF THE INVENTION

[Effect of the Invention] As explained above, according to this invention, in the game which appears in three-dimension game space and which attacks by receiving in label, it is effective in the ability to provide damage production with the three-dimension game equipment in which the interesting high game of a reality is possible at a detail reflecting actuation of a player.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] How the hit judging (henceforth hit checking) with the cartridge and targets, such as an enemy fighter, with whom the player shot this kind of game equipment is performed, and how the damage given to a partner according to hit condition is directed become the important factor which influences the fun of a game. in rough hit checking, in where, if cartridge-ed production is the same, the fun of a game will be halved.
[0005] However, wherever it may label-hit, conventional three-dimension game equipment is a setup to which a fixed damage is given, and it is not constituted so that the damages which a partner receives by the hitting location may differ. For this reason, cartridge-ed production which is different where the cartridge hit is not made.
[0006] Although it becomes what has a very high reality for a player in respect of this by battle in three-dimension space especially in order to deliver an attack from various directions while an enemy and the fighter of an ally carry out three-dimension migration like actual air warfare Since actuation of a player was not reflected in cartridge-ed production by the detail but only very rough cartridge-ed production was made, this became a cause, the reality of a game was spoiled and there was a problem of reducing the fun of game production.
[0007] This invention is made in view of such a technical problem, and the purpose is in providing damage production with the three-dimension game equipment in which the interesting high game of a reality is possible at a detail reflecting actuation of a player in the game which appears in three-dimension game space and which attacks by receiving in label.

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OPERATION

[Means for Solving the Problem and its Function] It is an actuation means for games by which a player operates invention of claim 1 in order to attain said purpose, A game operation means to perform the game operation which appears in three-dimension game space and which attacks by receiving in label based on the input signal and the predetermined game program from said actuation means, In the three-dimension game equipment which displays the game screen of an implication and said virtual three-dimension game space on a display said game operation means It is based on said label coordinate location in said virtual three-dimension game space. A damage area setting means to set up two or more damage area which specifies said amount of damages of a rank which receives in label and is different, Said attack location which receives in label is characterized by performing game production based on the label-amount of damages including a damage operation means to calculate said label damage to receive, based on whether it is contained in said damage area of which rank.
[0009] In order that a target may determine the magnitude of the damage received by attack according to invention of claim 1, the damage area setting means has set up two or more damage area which specifies the amount of damages of a rank which receives in label and is different on the basis of the label coordinate location in virtual three-dimension space. The label damage to receive is calculated based on whether the attack location which receives in [a damage operation means] label is included in the damage area of which rank.
[0010] Therefore, the production of the target which had the volume in virtual three-dimension space according to this invention from which the magnitude of the damage to receive differs by whether the attack was received in which the location is attained, and he can offer the game equipment which can perform game production which was more rich in the reality.
[0011] In order to attain said purpose, invention of claim 2 is set to claim 1, and it is said actuation means for games, It carries out that the attack [which appears in game space] location which receives like [are formed so that it may turn in label and the item for an attack may be discharged, and / said damage operation means] a label of said item for an attack was formed based on whether it is contained in said damage area of which rank so that said label damage to receive might be calculated as the description including the trigger actuation means for predetermined attack item discharge.
[0012] According to invention of claim 2, a damage operation means detects whether it is contained in the damage area of which label rank of the attack location calculated based on the input of the trigger actuation means of a player, and is calculating the label amount of damages to receive.
[0013] Therefore, according to this invention, it becomes possible to change the production of the damage given in label with the label attack location to receive, and the game equipment which can perform game production which was more rich in the reality can be offered.
[0014] In order to attain said purpose, invention of claim 3 is characterized by forming said damage operation means so that said label damage to receive may be calculated based on whether the moving trucking of said item for an attack passes through said damage area of which rank in claim 2.
[0015] According to invention of claim 3, a damage operation means detects whether the ballistic

trajectory calculated based on the input of the trigger actuation means of a player passes through the damage area of which label rank, and is calculating the label amount of damages to receive.

[0016] Therefore, it becomes possible to change the production of the damage given in label by which label location the cartridge hit, and the game equipment which can perform game production which was more rich in the reality can be offered.

[0017] Moreover, invention of claim 4 is characterized by being formed based on to said damage area of which rank the effect area at the time of explosion of said item for an attack attains said damage operation means, so that said label damage to receive may be calculated in either of claims 2 and 3.

[0018] According to invention of claim 4, a damage operation means detects to the damage area of which label rank the area where the explosion on the moving trucking of the item for an attack does damage reaches, and the label amount of damages to receive is calculated.

[0019] Therefore, when the item for an attack explodes, a target becomes possible [changing the production of the damage given in label by in which location it was], and can offer the game equipment which can perform game production which was more rich in the reality.

[0020] Moreover, in either of claims 1-4, as for invention of claim 5, said damage area setting means is characterized by said thing [having set up two or more damage area of a rank] in it so that the endocyst of the damage area where the amount of damages is big is carried out to the small damage area of the amount of damages, it approaches it in a label criteria location, and the amount of damages may become large.

[0021] By establishing a criteria location in a label-core according to invention of claim 5, when it suffers damage in the place near a core, and a serious damage is received and it suffers damage in a label-edge, production which receives a small damage is attained.

[0022] Moreover, the degree of a damage is changeable whether in the case of the collision judgement of said mobile, said cartridge and other mobiles, or a body, it grazed whether it collided directly.

[0023] Moreover, invention of claim 6 is characterized by said damage operation means judging whether said attack location which receives in label is included sequentially from the small rank of the amount of damages in said damage area of which rank in claim 5.

[0024] When damage area is set up like claim 5, the endocyst of the damage area where the amount of damages is big is carried out to the damage area where the amount of damages is small. Therefore, the count of decision increases and the amount of operations also increases as a damage will become large, if it judges whether an attack location is included sequentially from outside damage area. If it does in this way, when the amount of damages is small, there can be few amounts of operations, and it can end, and can judge by the useless operation which is not.

[0025] Moreover, invention of claim 7 is characterized by said damage area setting means setting said each damage area as a rectangular parallelepiped configuration in either of claims 1-6.

[0026] If a damage area setting means sets up each damage area like invention of claim 7, a damage area judging means will judge the amount of damages by detecting whether the coordinate showing the attack location in virtual three-dimension space, a hit location, or the effect area at the time of explosion is included in the damage area of each rank of a rectangular parallelepiped configuration. Therefore, if the core of the damage area of each rank of this rectangular parallelepiped configuration is set as a label hit alignment, the operation for the judgment which a damage area judging means performs can perform a damage judging in the amount of operations only with few degree operations of a coordinate.

[0027] Moreover, invention of claim 8 is characterized by said damage area setting means setting up said each damage area in the shape of a globular form in either of claims 1-6.

[0028] If a damage area setting means sets up each damage area like invention of claim 8, a damage area judging means will judge the amount of damages by detecting whether the coordinate showing the attack location in virtual three-dimension space, a hit location, or the effect area at the time of explosion is included in the damage area of each globular form rank. Therefore, if the core of the damage area of each of this globular form rank is set as a label hit alignment, the damage judging reflecting the distance from a target core can be performed.

[0029] In either of claims 2-8, said game operation means is characterized by the migration target by whom a player mobile moves and appears the inside of three-dimension game space in game space from a player mobile based on the actuation signal from said trigger actuation means, or to be formed so that it may turn in quiescence label and the item for an attack may be discharged by invention of claim 9 based on the input signal from said actuation means for games.

[0030] According to invention of claim 9, an enemy can be attacked moving in the inside of virtual three-dimension space, when a player operates the actuation means for games, and the game equipment which performs game production which inflicts the damage according to the attack on an enemy can be offered.

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EXAMPLE

[Example] Next, the suitable example of this invention is explained to a detail based on a drawing.

[0032] A suitable example of the business-use video game equipment with which this invention was applied is shown in drawing 1 . The video game equipment of an example has the cockpit section 10 and the display 30 arranged ahead [the].
[0033] Said cockpit section 10 is formed supposing the cockpit of a fighter. If the player which sat on the sheet 12 throws in predetermined coin from the coin injection section 18 and a start button 20 is operated, a game will start and the game screen 300 will be displayed on a display 30. The scene which is in sight at the front of the cockpit section 10 in the three-dimension game space beforehand set up so that it might mention later is displayed on this game screen 300. An enemy's fighter 532 is flying in this three-dimension game space. In addition, since it is easy to operate the way of the image which is visible to a beginner, the scene seen from the back slant of a self-opportunity may be made to be displayed.
[0034] As shown in drawing 2 , the operation lever 14 and the speed lever 16 are formed in this cockpit section 10 as a controlling gear. By pushing down forward and backward, said operation lever 14 controls a fighter to the bottom or facing up (the direction of the y-axis), and controls it by pushing down on a longitudinal direction to circle in a fighter the right or leftward (the direction of a x axis). Furthermore, the speed lever 16 controls the speed to front (the direction of the z-axis) by operating this. a player — the operation lever 14 — operating it — the posture of its own fighter — and it is suitable, it controls, the speed lever 16 is operated, its speed is controlled, an enemy's fighter 532 is pursued or a terrestrial enemy base is discovered. and it is alike like labels, such as the enemy fighter 532 which appears on the game screen 300, and an enemy base, collimation 320 is doubled, the trigger carbon buttons 22 and 24 are operated, a machine gun and a missile are launched, a target is defeated, and a score is got.
[0035] The functional block diagram of the business-use video game equipment of an example is shown in drawing 3 .
[0036] The business-use video game equipment of an example includes the player control unit 40, the game operation part 100, the image composition section 200, and a display 30.
[0037] Said player control unit 40 is a member which the player of the various levers 14 and 16 shown in drawing 2 and manual operation buttons 20 and 22, and 24 grades operates. The actuation signal is inputted into the game operation part 100.
[0038] Based on the game program beforehand determined as the input signal from a control unit 40, the game operation part 100 performs various kinds of game operations, outputs data required for image composition to the image composition section 200, and is constituted including the game space operation part 110, the map information storage section 130, and the mobile information storage section 140.
[0039] There are what moves [fighter], and a thing of immobilization of the location of the ground, a crest, an enemy base, a river, etc. in the object which constitutes three-dimension space.
[0040] The object number of the object which expresses the image of the enemy fighter which should be displayed on the positional information, the direction information, and these locations

of a mobile, such as an enemy fighter, to the mobile information storage section 140 is memorized (this location, direction information, and object number that were memorized are hereafter called mobile information).

[0041] Moreover, the map information which consists of the ground, a crest, an enemy base, a river, etc. is divided into the map information storage section 130 in the shape of a rectangle, and the object number of the object showing the image of the ground, the crest, etc. which should be displayed on the positional information and this location of this divided map is memorized (this positional information and object number that were memorized are hereafter called division map information).

[0042] The predetermined game program is memorized by the storage section (not shown) prepared in the game space operation part 110. The game space operation part 110 calculates the position coordinate of a self-opportunity fighter according to the self-opportunity fighter information read from the actuation signal and the mobile information storage section 140 from this game program and a control unit 40. Furthermore, the game space operation part 110 also calculates the position coordinate of other mobiles based on the mobile information read from a game program and the mobile information storage section 140. And game space is set up based on the division map information read from the position coordinate of a self-opportunity fighter, the position coordinate of other mobiles, and the map information storage section 130.

[0043] Thus, in this example, a fighter moves by operation of a player in the inside of the predetermined three-dimension game space set up as shown in drawing 4 (A), signs that a player attacks an enemy's fighter are calculated, and the result of an operation is outputted to the image composition section 200.

[0044] Since an image is supplied to a display every [1/] 60 seconds with the game equipment of this example, the game space operation part 110 calculates the position coordinate in the world coordinate of each mobile every [1/] 60 seconds, and is outputting it to the image composition section 200.

[0045] In addition, the detail of data processing which can set this game space operation part 110 hit judging section 120 is mentioned later.

[0046] The image composition section 200 forms the false three-dimension image which actually appears from a player according to the result of an operation of the game operation part 100, displays it on a display 30, and is constituted including the three-dimension operation part 220, the image drawing section 240, and the object image information storage section 260.

[0047] The image information of mobiles, such as an enemy fighter specified by the aforementioned object number, and image information, such as the ground, a crest, and an enemy base, are memorized by said object image information storage section 260.

[0048] In this case, such image information is expressed as a set of two or more polygons. For example, as shown in drawing 5 , the mobile objects 510, such as an enemy fighter, are a polygon 512-1,512-2 and -512-5. — It is expressed by the set. And the image information of this polygon 512-1 - 512-5 — which consists of each top-most-vertices coordinate etc. is memorized by the object image information storage section 260. Similarly, map information, such as an enemy base which is a map object, is also expressed as a set of a polygon, and the image information which consists of a top-most-vertices coordinate of this polygon etc. is also memorized by the object image information storage section 260.

[0049] The three-dimension operation part 220 reads the image information which corresponds from the object image information storage section 260 based on the inputted data (mobile information and division map information), and sets it to game space as a set of two or more polygons. From the positional information of each object inputted by the world coordinate at this time, processing which searches for the top-most-vertices coordinate in the view system of coordinates of a set of the polygon which constitutes each object is performed. That is, since the output coordinate of game space operation part is a world coordinate, it performs coordinate transformation to view system of coordinates. And clipping processing which removes the data out of a visual field, perspective-projection conversion in a screen coordinate system, sorting processing, etc. are processed, and the data after processing are outputted to the image drawing section 240.

[0050] In the image drawing section 240, image information which should actually be visible from a player is formed from these inputted data. That is, since the data inputted from the three-dimension operation part 220 are expressed as image information which consists of top-most-vertices information on a polygon etc., in the image drawing section 240, formation of the image information in all the dot inside a polygon is performed from the top-most-vertices information on this polygon etc. And the data after processing will be outputted to a display 30, and a virtual three-dimension image as shown in drawing 4 (B) will be formed.

[0051] In addition, as the operation technique of the image composition in the image drawing section 240, it may ask for the border line of a polygon from the top-most-vertices coordinate of a polygon, and may ask for the profile point pair which is the intersection of this border line and scanning line, and the technique of making Rhine formed of this profile point pair correspond to predetermined color data etc. may be used. Moreover, ROM etc. may be made to memorize beforehand the image information of all the dots in each polygon as texture information, and the technique called texture mapping of read and sticking this may be used by making into the address the texture coordinate which each top-most vertices of a polygon were given.

[0052] The principle Fig. of the image composition technique is shown in drawing 6 .

[0053] The information about the three-dimension object 510 which appears at the game equipment of an example in the map information in the three-dimension game space 500 and this three-dimension game space 500 is beforehand memorized by the map information storage section 130 and the mobile information storage section 140 in the game operation part 100.

[0054] Moreover, the image information about said three-dimension object 510 is expressed as a geometric model which consists of two or more polygons 512-1,512-2,512-3 and ...., and is beforehand memorized by the object image information storage section 260.

[0055] If the fighter game of this example is taken for an example, the three-dimension object 510 is fighter 532 grade which appears in the three-dimension game space 500, and various kinds of three-dimension objects which, in addition to this, express the background of the ground 519, a crest 520, a building 522, a position 524, etc. as shown in drawing 4 are arranged in the three-dimension game space 500.

[0056] Perspective-projection conversion is carried out in the image composition section 200 on the perspective-projection side 620 of view system of coordinates centering on the view 610 of the virtual player P, and these three-dimension objects are displayed on a display 30 as a false three-dimension image 522.

[0057] The physical relationship of the fighter 530 which the player in the three-dimension game space 500 controls, and an enemy's fighter 532 is shown in drawing 7 . Although the three-dimension game space 500 is expressed with a world coordinate (XW, YW, and ZW) in principle, it is expressed with the view system of coordinates which set the view 610 shown in drawing 6 as the location of the cockpit of the fighter 530 which a player controls in this drawing. The direction of the look of a view 610 is defined as the z-axis, they define a x axis and the vertical direction for a longitudinal direction as the y-axis, and these view system of coordinates move with migration of the self-opportunity 530. Therefore, if a player makes it a front [control unit / 40] and looks at a display 30 from a view 610, he can sit on the cockpit of a fighter and an image which is located in the three-dimension game space 500 can be seen.

[0058] When a player operates control-lever 14 grade and rotation of the fighter by which he has ridden virtually, advancing side by side, etc. are operated, the location of the view 610 over the three-dimension game space 500 will change, and the three-dimension game space 500 will rotate and advance side by side. For this reason, the game operation part 100 calculates rotation of the three-dimension object 510 which constitutes the three-dimension game space 500 based on this actuation signal and a game program and which is a fighter, or other three-dimension objects, advancing side by side, etc. on real time. And in the image composition section 200, perspective-projection conversion is carried out on the perspective-projection side 620, and these three-dimensions object is displayed on a display 30 as a false three-dimension image 522 which changes on real time.

[0059] When the technique of computer graphics is used, said three-dimension object 510 is creating the geometric model using independent body system of coordinates. That is, each polygon which constitutes the three-dimension object 510 is arranged on these body system of coordinates, and that geometric model is specified.

[0060] Furthermore, the three-dimension game space 500 is constituted using a world coordinate (XW, YW, and ZW), and the three-dimension object 510 expressed using body system of coordinates is arranged in a world coordinate according to the movement model.

[0061] And by making the location of a view 610 into a zero, data are changed into the view system of coordinates which took the direction of a look in the forward direction of the z-axis, and perspective-projection conversion of each coordinate is carried out to the screen coordinate system which is plane of projection 620. Thus, the image within the visual field of the three-dimension game space 500 which is visible from a view 610 can be displayed on a display 30. Therefore, a player can carry out the virtual simulation of the condition of attacking the hostile aircraft, by operating levers 14 and 16 and trigger buttons 22 and 24, controlling a fighter for the inside of the three-dimension game space 500.

[0062] In the business-use game equipment of an example, if a game is started, the fighter which a player controls will fly about the virtual three-dimension game space 500 shown in drawing 4 freely, and will attack a hostile aircraft, an enemy base, etc. by the vulcan cannon or the missile.

[0063] Drawing 8 expresses the three-dimension game space 500 as x of view system of coordinates, and two-dimensional space of z. In this drawing, 560 is the field-of-view range of the fighter which a player controls, and, as for a **** range of visibility and 562, 564 is [the Balkan Peninsula effective range distance and 566] the missile maximum ranges.

[0064] Therefore, even if it discharges a missile and a vulcan cannon towards the enemy fighter which is not contained in the missile maximum range 566 and the Balkan Peninsula effective range distance 562, an attack cannot do an enemy fighter effectively.

[0065] A more detailed example of the game screen displayed on a display 30 is shown in drawing 9 . Only when the enemy fighter 532 is located in the field-of-view range 560 in the three-dimension game space 500 and the location is moreover located to the front than the **** range of visibility 564 shown in drawing 8 , the game equipment of an example is formed so that the image of the enemy fighter 532 may be displayed on a game screen. And target DISHIGUNETA 310a is displayed on the display position of the enemy fighter 532 in piles. This target DISHIGUNETA 310a shows the location of the enemy fighter 532, and the enemy fighter 532 is located at the core of that circle. Therefore, a player can check easily the enemy fighter 532 which exists in the game screen 300 by this target DISHIGUNETA 310a.

[0066] Furthermore, if the enemy fighter 532 enters in the missile range circle 324, the missile seeker 322 will be displayed automatically and will start migration towards the enemy fighter 532. And if this missile seeker 322 laps with target DISHIGUNETA 310a, a missile will be in the condition that lock on was carried out at the enemy fighter 532. In this condition, if a player operates the trigger carbon button 24 for a missile launch, as shown in drawing 11 , a missile 582 will be launched, and tailing to the enemy fighter 532 will be started. Usually, although this missile 582 will track the enemy fighter 532 automatically and the enemy fighter 532 will be hit, as the game operation part 100 detects this missile launch and a case is shown in drawing 11 , game production which emits a chaff 312 from the enemy fighter 532 may be performed.

[0067] Whether a missile 582 is disturbed by this chaff 312 depends for this probability on game level further according to a probability. When disturbed, a missile 582 carries out sequential tailing, as shown in drawing 11 (A), (B), and (C) for the purpose of a chaff 312, and explodes on the point of a chaff 312.

[0068] Moreover, if the enemy fighter 532 is located within the limits of the Balkan Peninsula effective range distance 562 shown in drawing 8 , as shown in drawing 9 , the vulcan-cannon collimation 320 will be displayed in the center of the game screen 300. By doubling collimation with the enemy fighter 532 using this vulcan-cannon collimation 320, and operating the trigger carbon button 22 for vulcan cannons, as shown in drawing 10 , a vulcan cannon can be discharged towards the enemy fighter 532, and this can be shot down.

[0069] In addition, ******** of the item 350 for an attack to hold is performed in the radar 340 which displays the location of the enemy fighter 532 on the left corner of this game screen 300, and a lower right corner, and the game residual time 330 is displayed on an upper right corner.

[0070] Moreover, in order to perform said vulcan cannon and hit judging actuation of a missile to the game equipment of this example, the hit judging section 120 is formed in the game space operation part 110.

[0071] This hit judging section 120 compares the cartridge 580 of a vulcan cannon discharged from the fighter 530 of a player, and the location P2 of a missile 582 with the location P1 of the enemy fighter 532 which is a target, and it is constituted so that that hit judging may be performed.

[0072] And if a vulcan cannon and a missile hit an enemy, it is constituted so that explosion etc. may be directed visually and in acoustic sense.

[0073] by the way, in this kind of game, how hit-checking actuation with the cartridge and target which the player shot is performed, and how the damage given to a partner according to hit condition is directed influence the fun of a game — it comes size and becomes 7s factors. The fun of a game will be halved in rough hit checking.

[0074] For this reason, the hit judging section 120 of an example is constituted on the basis of the coordinate location P1 of the enemy in three-dimension game space 500 so that the damage area setting section 122 which sets up two or more damage area which specifies said amount of damages of a rank which receives in label and is different, and the damage operation part 124 which calculate the damage which can set in label based on whether said attack location which receives in label is included in the damage area of which rank may contain.

[0075] The example of damage area over the enemy fighter 532 is shown in drawing 12 (A). In the example, two or more cubes centering on an airframe core are set up as second hit-checking box 700,710 for a start as said damage area, and it is formed so that a damage judging may be performed. In here, the second hit-checking box 710 is small, and the first hit-checking box 700 is formed greatly, and the second hit-checking box 710 is set up so that endocyst may be carried out to the first hit-checking box 700. In addition, the first hit-checking box 700 is set up more greatly than the size of the actual enemy fighter 532, in order to make shooting easy. And to the second hit-checking box 710 located in a core side, the big amount of damages is set up and the small amount of damages is relatively set to the first hit-checking box 700 located outside.

[0076] Thus, the damage area setting section 122 of an example is performing a rank setup of each of said hit-checking box 700,710 so that the endocyst of the hit-checking box 710 where the amount of damages is big is carried out, it approaches the hit-checking box 700 where the amount of damages is small in the center position P1 of the enemy fighter 532 which is a target, and the amount of damages may become large.

[0077] Moreover, based on whether the attack location to the enemy fighter 532 which is the target of the item for an attack is included in the hit-checking box of which rank, said damage operation part 124 is formed so that the damage of the enemy fighter 532 which is a target may be calculated. In this example, the damage judgings differ a little by the case where a vulcan cannon is used as an item for an attack, and the case where a missile is used.

[0078] In drawing 12 (B), the damage judging actuation at the time of using a vulcan cannon is shown, and the damage judging actuation at the time of using a missile is shown in this drawing (C) at it.

[0079] First, the damage judging actuation at the time of using a vulcan cannon is explained. The hit-checking boxes 700 and 710 of the enemy fighter (not shown) which receives an attack by the vulcan cannon are shown in drawing 12 (B). A player discharges a vulcan cannon towards an enemy fighter (not shown), and the locus of the projectile 580 assumes the case where it moves in order of 580-1,580-2—580-3 as shown in this drawing. At this time, said damage operation part 124 calculates the damage in the enemy fighter 532 which is a target based on whether the moving trucking of a projectile 580 passes through the hit-checking box of which rank. For example, when the moving trucking of a projectile 580 passes neither of each hit-checking box 700,710, it is judged that the projectile separated and the operation of a damage is not performed.

[0080] Moreover, if the moving trucking of a projectile 580 passes through the first hit-checking box 700, the damage operation part 124 will judge whether the locus of a projectile passes through the second hit-checking box 710 next. When it is judged that it does not pass through the second hit-checking box 710, it judges that it passed only through the first hit-checking box 700, and an operation setup of the small amount of damages is performed. When [which passes through the second hit-checking box 710] judged, from that of the airframe of the enemy fighter 532, it is judged that the part near a core was hit and an operation setup of the big amount of damages is performed.

[0081] Moreover, also when a missile 582 is launched towards the enemy fighter 532, as for said damage operation part 124, a damage operation as well as [as a principle] hit-checking actuation of a vulcan cannon is performed. That is, if said missile 582 hits the enemy fighter 532, a game operation will be performed so that it may explode in a hit location. And an operation setup of the amount of damages from which the explosion differs based on to any of a hit-checking box it shall belong between said first and the second is performed.

[0082] Moreover, the concept of an explosion radius is also set to said missile 82. For example, as shown in drawing 11 , the enemy fighter 532 drops a chaff 312, and when a missile collides with this chaff 312 and explodes, an explosion location will be included in both [of the hit-checking box 700,710] the first and the second.

[0083] Even in this case, from this explosion location, it is judged whether either of the second hit-checking box 700,710 exists for a start in the radius of r, and an operation setup of the amount of damages is performed.

[0084] In addition, when a vulcan cannon and a missile hit the hit-checking box same with a natural thing, compared with a vulcan cannon, the damage in the direction of a missile is serious, and is set up. Moreover, as shown in drawing 12 (C), when it explodes outside a hit-checking box compared with the case where a missile 582 explodes in said hit-checking box even when the same missile explodes, it cannot be overemphasized that the amount of damages is set up small.

[0085] And the game space operation part 110 of an example will direct cartridges-ed, such as large and small explosion and emitting smoke, visually and in acoustic sense, if a missile and a vulcan cannon hit an enemy.

[0086] Moreover, the enemy fighter 532 has the strength determined in the magnitude of the damage received before, and it has declined in the strength, so that the damage received before is serious. Therefore, as the hostile aircraft in which carried out the cartridge-ed once and the strength declined, and the enemy who has not done a cartridge-ed yet, cartridge-ed production which is different even when the same cartridge-ed as a degree is received will be performed, and the game screen where a reality is more high will be displayed.

[0087] Drawing 14 is the game screen which displayed the appearance of the cartridge-ed of a hostile aircraft. Sequentially from this drawing (A), the production screen at the time of receiving a serious damage is shown according to this drawing (E).

[0088] If a hostile aircraft can give a damage by the missile and the Balkan Peninsula, production of the cartridge-ed according to the amount of damages will be performed. The engine performance falls according to the amount of damages, and, as for the enemy who did the cartridge-ed, rotation etc. becomes slow.

[0089] when there are few amounts of damages, it is shown in this drawing (A) -- as -- the smoke of a white system -- little **** -- production [like] is performed. An increment of a damage makes production which a fire generates, as shown in this drawing (B).

[0090] Production of explosion is performed while being shown in the small explosion and this drawing (D) showing in this drawing (C) in the place where the damage exceeded the constant rate. Although smallness and inside explosion take place at random fundamentally, the probability is changed according to the situation of the strength of course selection, a stage, residual time, and an enemy etc.

[0091] And if an enemy's strength becomes zero, the explosion screen shown in this drawing (E) will be displayed.

[0092] The flow chart of hit judging actuation of the equipment of an example and damage production actuation is shown in drawing 13 .

[0093] In addition, in order to simplify explanation, it explains taking the case of the case where hit checking of a vulcan cannon is performed here.

[0094] First, a player controls a fighter 530 and assumes the case where ****** and a vulcan cannon are discharged for the enemy fighter 532 to the vulcan-cannon collimation 320 neighborhood as shown in drawing 10 .

[0095] The relation between the three-dimension coordinate location P1 of the enemy fighter 532 at the time of making the player fighter 530 into the zero of view system of coordinates at this time and the three-dimension coordinate location P2 of the discharged cartridge 580 of a vulcan cannon is shown in drawing 7 .

[0096] The damage operation part 124 will detect whether it passed through the enemy fighter 532 hit-checking box 700,710 which this ballistic trajectory shows to drawing 12 (A) based on the present coordinate location P2 of the discharged cartridge 580, if it does in this way and a vulcan cannon is discharged.

[0097] As shown in drawing 12 (B), when a cartridge 580 is in the exterior of the first hit-checking box 700 like 580-1, a hit is not detected yet, but a hit is detected when a cartridge 580 comes to the interior of the second hit-checking box 700 like 580-2.

[0098] Hit checking of the first hit judging, and the call and the second hit-checking box 710 is called the second hit judging for hit checking with the first hit-checking box 700 below for explanation. Moreover, the first hit signal, the second hit signal, and a call and the output when separating are called the first blank signal and the second blank signal for the output when hitting to each.

[0099] In the first hit judging, hit-checking actuation is performed by comparing the difference of X of the coordinate P2 of a cartridge 580 expressed with the world coordinate, and the core of the hit-checking box 700, Y, and Z coordinate data with each reference value of the X coordinate for the first hit judging which was able to be defined beforehand, Y coordinate, and a Z coordinate. Since the core of an airframe and the core of the first hit-checking box 700 are in agreement here, X of an enemy's fighter 532, Y, and Z coordinate data can be used as X of the core P1 of the first hit-checking box 700, Y, and Z coordinate data.

[0100] If one side of the P2 (X2, Y2, Z2) and first hit-checking box 700 is set to two a1 for the coordinate of P1 (X1, Y1, Z1) and a cartridge 580, the coordinate of the core of the first hit-checking box 700 The X coordinate, Y coordinate, and Z coordinate reference value for said first hit judging are set to a1, and the following relation is realized when the coordinate P2 of a cartridge 580 is in the interior of this first hit-checking box 700.

[0101]

$|X2 - X1| <= a1$ — (1)

$|Y2 - Y1| <= a1$ — (2)

$|Z2 - Z1| <= a1$ — (3)

Since the game screen is constituted so that a display may be supplied every [1/] 60 seconds, the game operation part 100 is calculating the value of the coordinates P1 (X1, Y1, Z1) and P2 (X2, Y2, Z2) in the world coordinate of a mobile every [1/] 60 seconds. a ******** [that, as for the damage operation part 124, the value will fill the relation of above-mentioned (1) - (3) about a cartridge and each object if a cartridge is discharged by trigger actuation] — checking — **** — the relation of above-mentioned (1) - (3) — when **** is all carried out, the first hit signal is outputted (step 10).

[0102] It is ********** about the above-mentioned hit-checking actuation every [1/] 60 seconds until the possibility of a hit disappears, when not filling. Existence of the possibility of a hit is performed by the physical relationship of the mobile in consideration of a future ballistic trajectory and migration, when partners are mobiles, such as an enemy fighter. That is, when a cartridge 580 comes to the location of 580-3 by drawing 12 (A), it is supposed that there is no possibility of a hit henceforth. Moreover, when it was not a mobile, the future ballistic trajectory separated from the partner and it calculates, it is supposed that there is no possibility of a hit. Thus, when there is no possibility of a hit, the first blank signal is outputted (step 10).

[0103] In addition, in the first hit judging, if the above-mentioned hit-checking actuation is performed only about the object which calculates a ballistic trajectory beforehand and has the possibility of a hit, the load of CPU will mitigate. And the first blank signal is outputted by the first hit judging, and if a ballistic trajectory is judged that there is no possibility of a collision in an enemy fighter (step 12), the usual game production will be performed (step 22).

[0104] Moreover, the first hit signal is outputted by the first hit judging, and if it is judged that the cartridge 580 has hit the hit-checking box 700 (step 12), the second hit judging of whether next a cartridge 580 hits the second hit-checking box 710 will be performed (step 14).

[0105] The second hit judging also gives the first hit judging and a principle target same hit-checking actuation. However, since the second hit judging confirms whether a cartridge 580 passes also through the second hit-checking box 710 in short time amount while a cartridge 580 passes through the first hit-checking box 700 as shown in drawing 12 (B), it is performed by repeating the above-mentioned hit-checking actuation in the cycle shorter than the first hit judging. That is, according to 1 [of a cartridge 580 and an enemy fighter] of 532 / coordinate value in every 60 seconds, and its movement condition, 1/60 second is divided into a still shorter cycle, and hit-checking actuation is performed in quest of each coordinate value.

[0106] If one side of P2 (X2, Y2, Z2) and the hit-checking box 710 is set to two a2 for the coordinate of P1 (X1, Y1, Z1) and the cartridge 580 for which carried out in this way and it asked, the coordinate of the core of the hit-checking boxes 700 and 710 The X coordinate, Y coordinate, and Z coordinate reference value for said second hit judging are set to a2, and the following relation is realized when the coordinate P2 of a cartridge 580 is in the interior of this second hit-checking box 710.

[0107] | X2 - X1| <= a2 — (4)
| Y2 - Y1| <= a2 — (5)
| Z2 - Z1| <= a2 — (6)

And the damage operation part 124 is ********** about the above-mentioned hit-checking actuation until it outputs the second hit signal when all the relation of above-mentioned (4) - (6) is filled, and the possibility of a hit disappears, when not filling. And if it judges that there is no possibility of a hit, the second blank signal will be outputted.

[0108] The second hit signal is outputted by the second hit judging, if judged with the cartridge 580 having hit the second hit-checking box 710 (step 16), large damage production (step 18) will be performed and a large damage production screen like drawing 14 (B) will be displayed.

[0109] If the second blank signal is outputted by the second hit judging and it is judged as a hit only in the first hit-checking box 700 (step 16), small damage production will be performed (step 20) and a small damage production screen like drawing 8 (A) will be displayed.

[0110] thus, the cartridge 580 — size — it is confirming whether it hit in which hit-checking boxes 700 and 710, when it hits in the hit-checking box 710, a serious damage is given to a partner, when it hits only in the hit-checking box 700, a small damage is given to a partner, and when other, the cartridge 580 does not give a damage noting that it has not hit the mark.

[0111] Thus, if the hit-checking boxes 700 and 710 are used as a cube, only by addition and subtraction and a size judging of a coordinate value, since hit checking is performed, the amount of data processing can be reduced sharply, and the burden of CPU can be mitigated. Moreover, although considered as the cube in this example, effectiveness is the same also as a rectangular parallelepiped.

[0112] Moreover, although the difficulty of shooting is decided by size of a hit-checking box, in this example, the hit-checking box 700 is set up more greatly than the size of the system for shooting difficulty relaxation. Therefore, it is become empty and lost that a game will be completed comparatively becoming easy for a beginner to hit the hit-checking box 700, and not hitting it at all. Moreover, since damage production changes with degrees of a hit, an upper person can enjoy the game in which its arm was reflected correctly.

[0113] Moreover, when it is a setup which can choose the difficulty of a game, it is made easy to take the larger hit-checking box of a hostile aircraft in for beginners, and to hit, it may be made hard to take the more smallish hit-checking box of a self-opportunity, and to hit, and in for upper persons, you may constitute so that it may become reversely [the].

[0114] Moreover, rotation which an operation load of rotate [although rotation of an airframe can be used for cubical rotation as it is since the hit-checking box centers on the airframe core / the hit-checking box itself] increases and which is united with an airframe posture in this example since the visual effectiveness on the appearance of a game is comparatively thin is not performed, but it is made the core coordinate of an airframe so much at immobilization.

[0115] In addition, this invention is not limited to said example and various kinds of deformation implementation is possible for it in the range of the summary of this invention.

[0116] Although said example explained taking the case of the case where each damage area is set up as a hit-checking box which carried out the cube configuration, this invention can be formed in various configurations not only this but if needed. Although especially this damage area is spatially set as the easy three-dimension configuration of an operation, it is desirable, for example, it is also possible to form in the shape of a globular form.

[0117] Moreover, in said each example, this setup was performed so that the endocyst of the damage area where the amount of damages is big might be carried out to the damage area where the amount of damages is small, but this invention may be arranged so that two or more damage area of not only this but a different rank may adjoin, and it may be set up so that that part may overlap again.

[0118] For example, the engine section may be used as another hit-checking box, or a production which used the vane as another hit-checking box, and is different may be made.

[Translation done.]

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the appearance perspective view of the game equipment of an example.
[Drawing 2] It is the appearance perspective view of the game equipment of an example.
[Drawing 3] It is the functional block diagram of the game equipment of an example.
[Drawing 4] They are the schematic diagram of the three-dimension game space of an example, and the explanatory view of a game screen.
[Drawing 5] It is the schematic diagram showing an example of the three-dimension object expressed by the set of a polygon.
[Drawing 6] It is an explanatory view about the synthetic principle of secondary three-dimension game images of an example.
[Drawing 7] It is the explanatory view showing the physical relationship of the player and target in three-dimension game space.
[Drawing 8] They are explanatory views, such as the missile maximum range in three-dimension space, and the Balkan Peninsula effective range distance.
[Drawing 9] It is the more detailed explanatory view of the game screen of an example.
[Drawing 10] It is the explanatory view of a game screen when attacking the enemy by the vulcan cannon.
[Drawing 11] The enemy fighter attacked by the missile is the explanatory view showing the condition of having dropped the chaff flare.
[Drawing 12] It is the explanatory view of the hit-checking box for the damage judging of this example.
[Drawing 13] It is the flow chart Fig. showing hit judging actuation of equipment and damage production actuation of an example.
[Drawing 14] It is the explanatory view of the damage production screen of an enemy fighter.
[Description of Notations]
30 Display
40 Control Unit
100 Game Operation Part
110 Game Space Operation Part
120 Hit Judging Section
122 Damage Area Setting Section
124 Damage Operation Part
200 Image Composition Section
220 Three-Dimension Operation Part
240 Image Drawing Section
260 Object Image Information Storage Section

[Translation done.]

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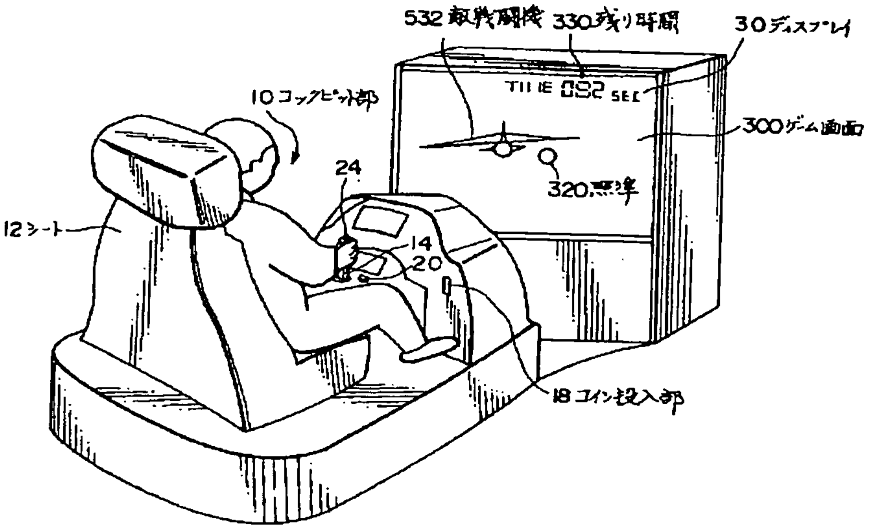
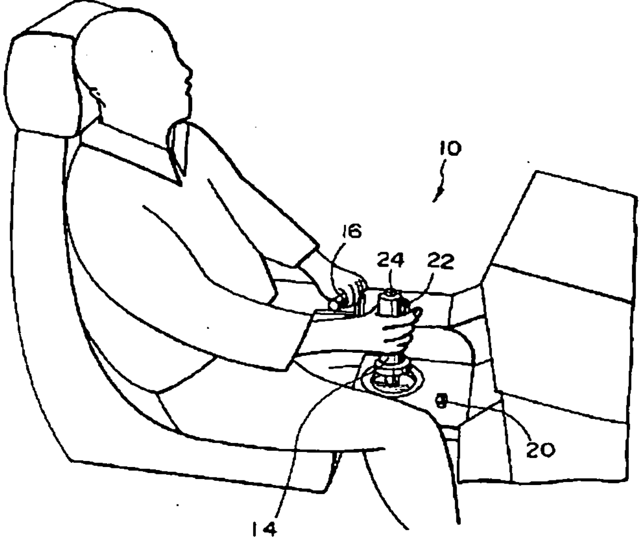
DRAWINGS

[Drawing 1]



[Drawing 2]



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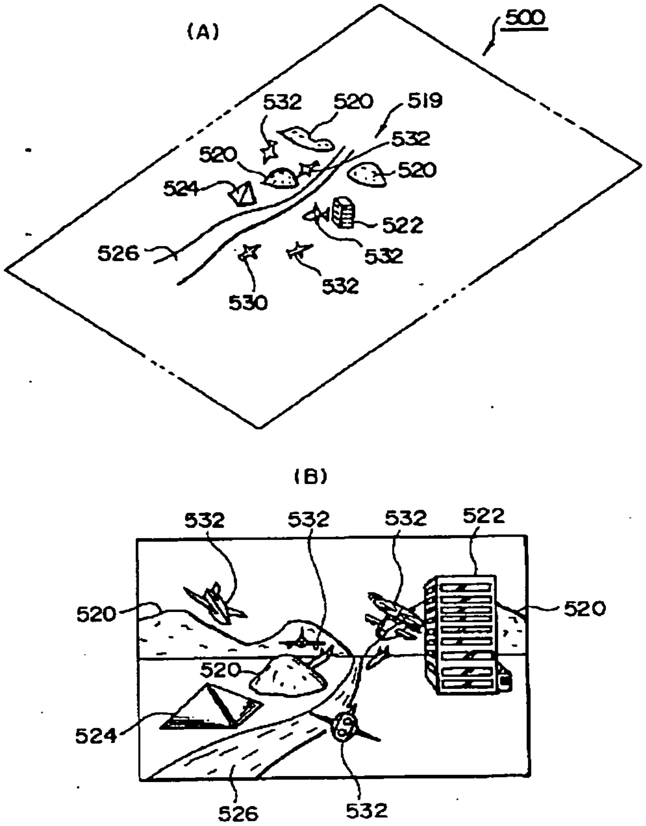
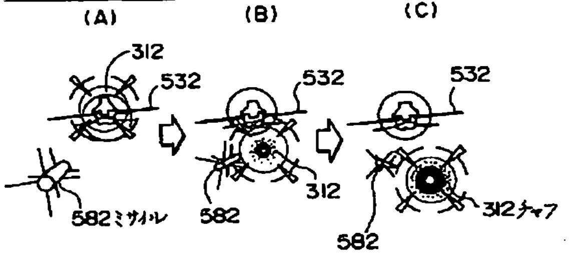
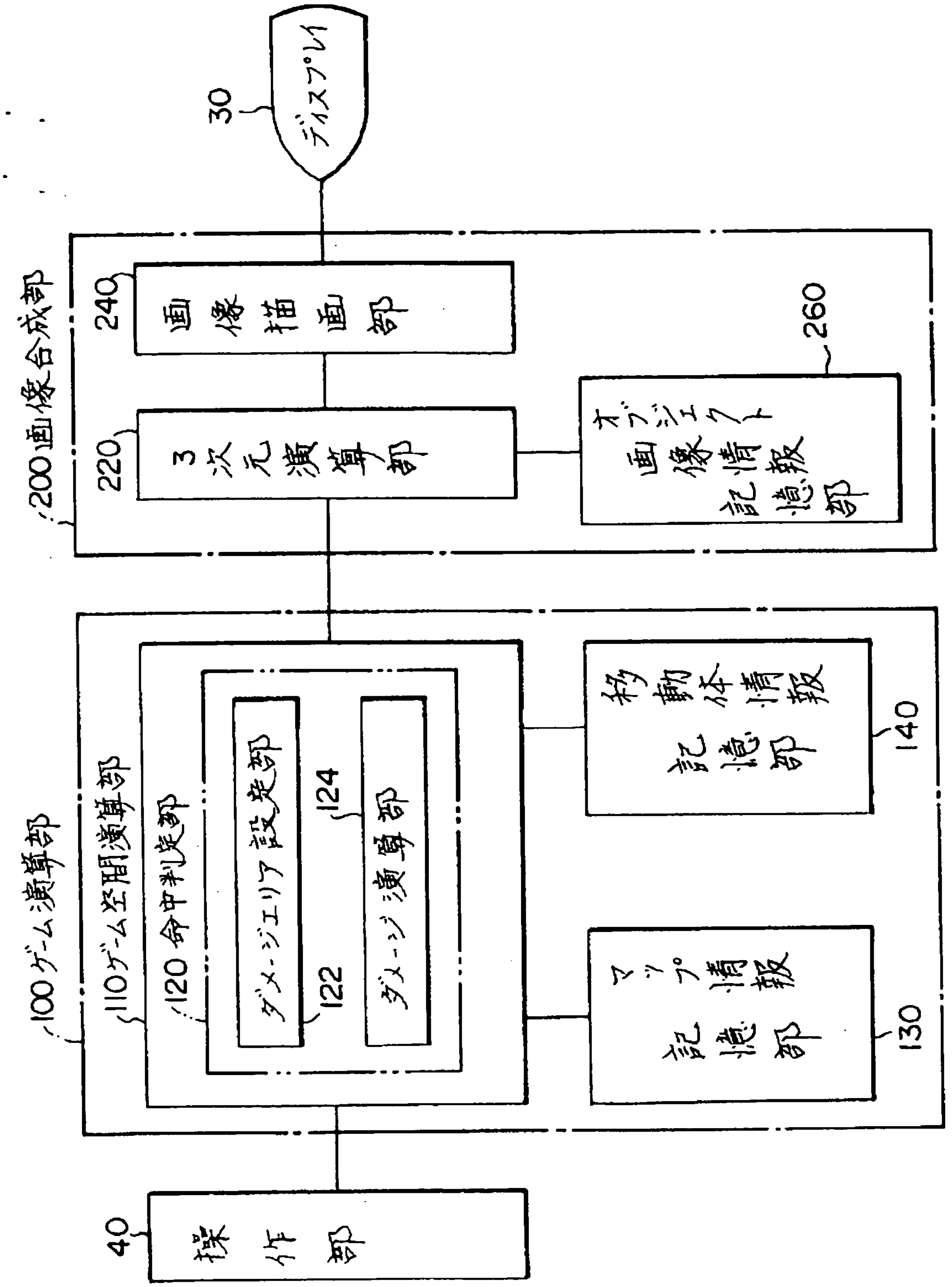


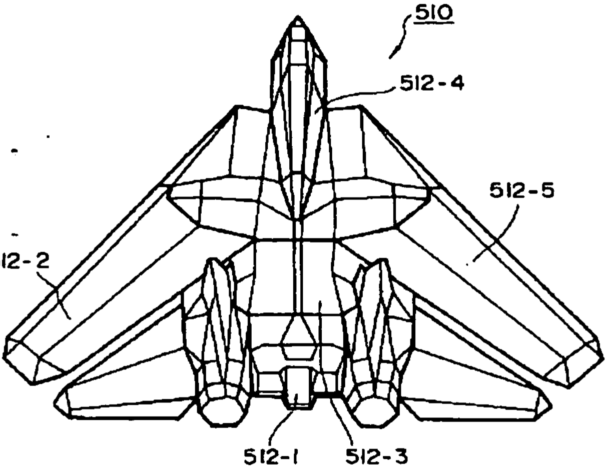
[Drawing 11]



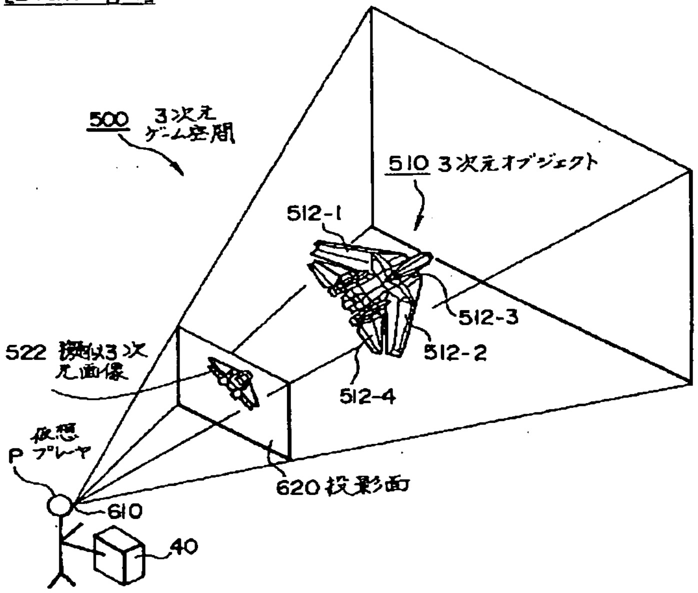
[Drawing 3]


30
ディスプレイ
200 画像合成部
240
画像描画部
220
3次元演算部
260
オブジェクト画像情報記憶部
100 ゲーム演算部
110 ゲーム空間演算部
120 命中判定部
122
ダメージエリア設定部
124
ダメージ演算部
140
移動体情報記憶部
130
マップ情報記憶部
40
操作部

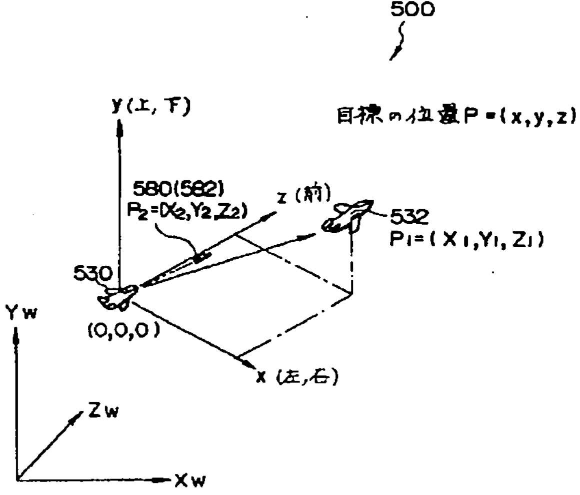
[Drawing 5]



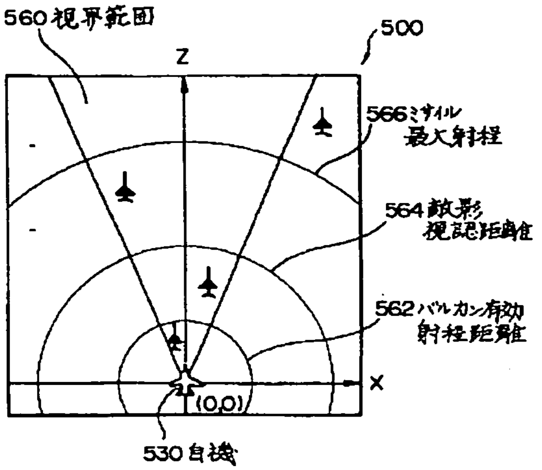
[Drawing 6]



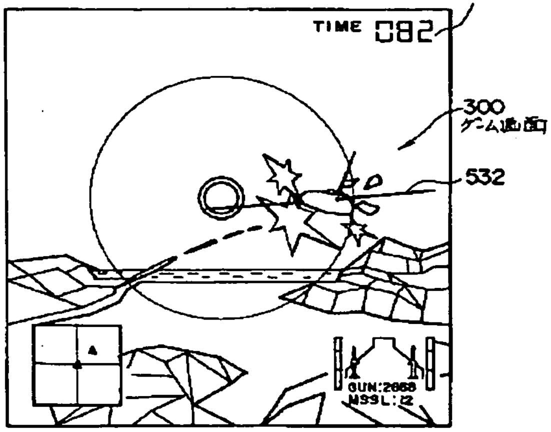
[Drawing 7]



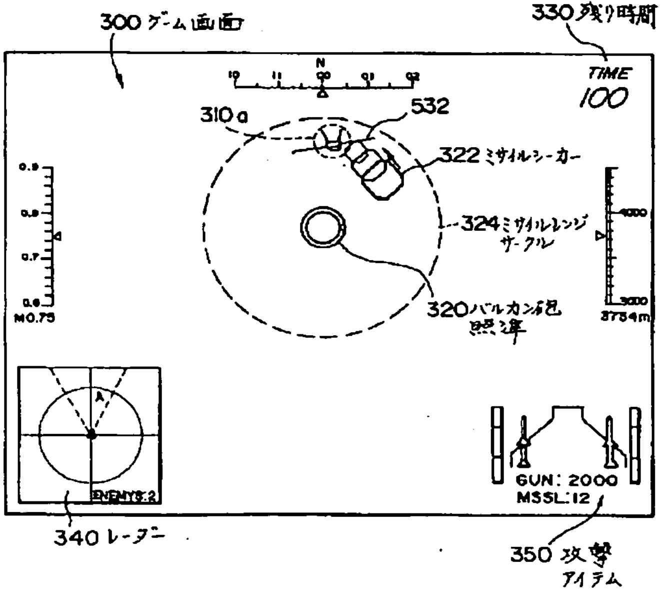
[Drawing 8]



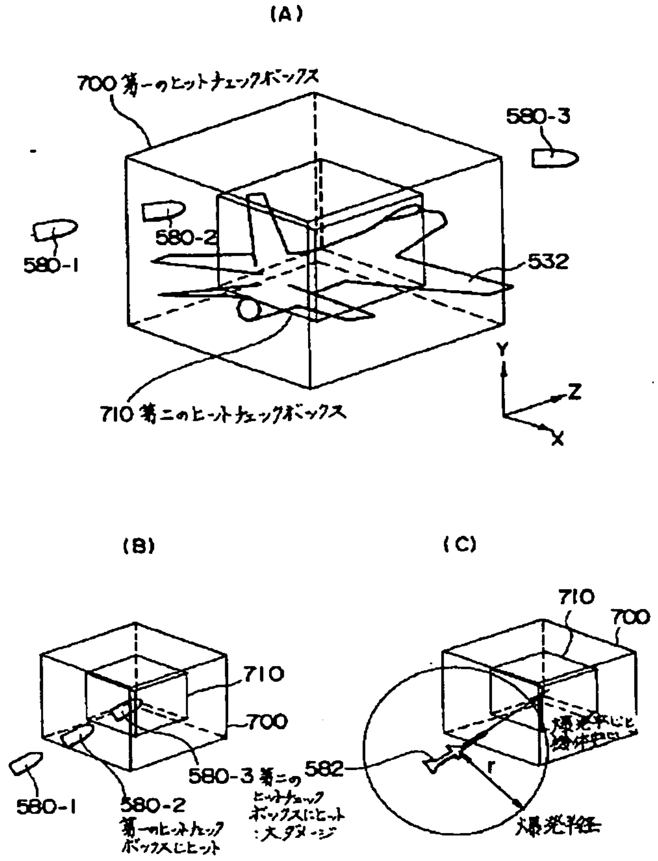
[Drawing 10]



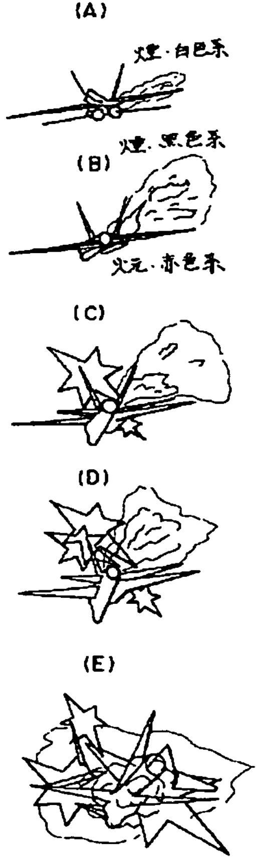
[Drawing 9]



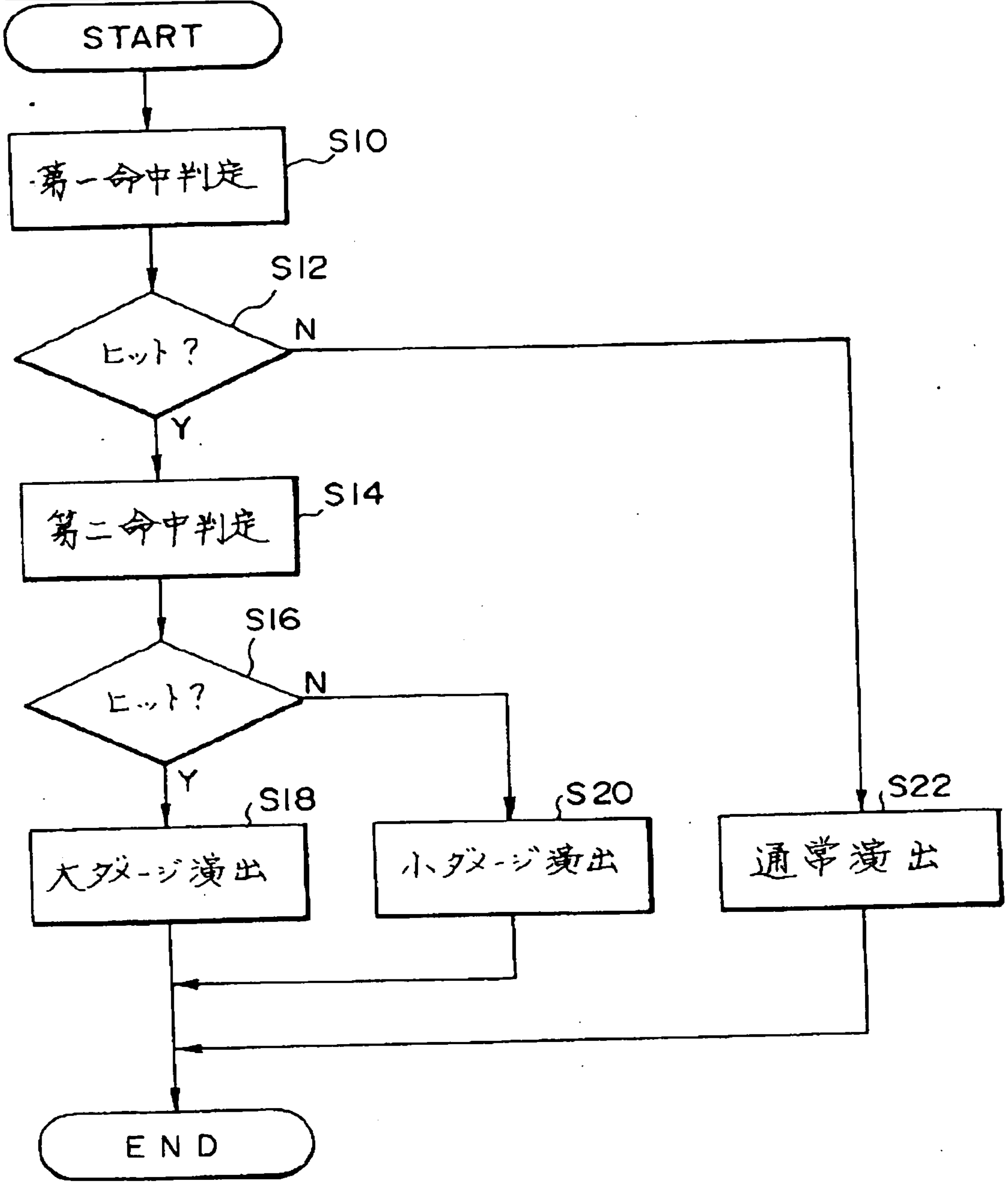
[Drawing 12]


(A)
700 第一のヒットチェックボックス
580-3
580-2
580-1
532
710 第二のヒットチェックボックス
Y
Z
X
(B)
(C)
710
700
580-1
580-2 第一のヒットチェックボックスにヒット
580-3 第二のヒットチェックボックスにヒット：大ダメージ
710
700
582
r
爆発中心と機体中心
爆発半径

[Drawing 14]


(A)
煙・白色系
(B)
煙、黒色系
火元・赤色系
(C)
(D)
(E)

[Drawing 13]



[Translation done.]

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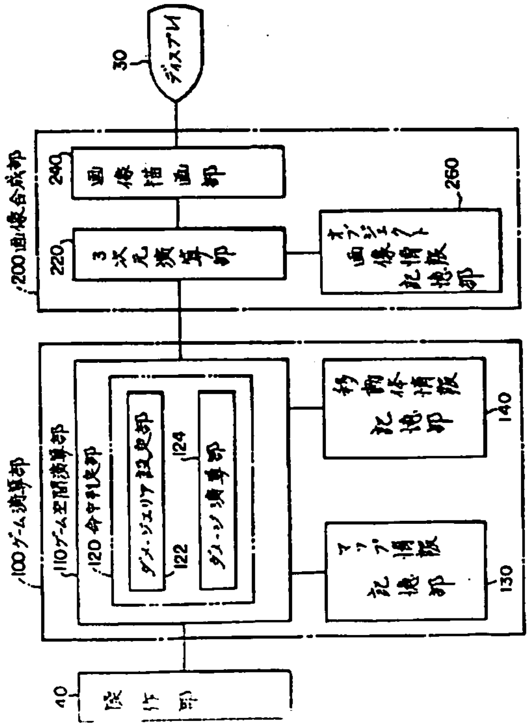
(54)【発明の名称】　３次元ゲーム装置

(57)【要約】

【目的】　仮想３次元ゲーム空間内で行われる衝突または命中判定において簡単な演算であたり具合を判定し、バライティに富んだダメージ演出を行うことができるゲーム装置を提供すること。

【構成】　操作部４０からの入力信号及び所定のゲームプログラムに基づき、３次元ゲーム空間内に登場する標的に対し攻撃を行い、前記仮想３次元ゲーム空間のゲーム画面をディスプレイ上に表示する３次元ゲーム装置である。前記ゲーム演算部１００は、前記仮想３次元ゲーム空間内における前記標的の座標位置を基準として、前記標的に対し異なるランクのダメージ量を規定する複数のダメージエリアを設定するダメージエリア設定部１２２と、前記標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかに基づき、前記標的の受けるダメージを演算するダメージ演算部１２４を含む。



【特許請求の範囲】

【請求項1】　プレーヤの操作するゲーム用操作手段と、
前記操作手段からの入力信号及び所定のゲームプログラムに基づき、3次元ゲーム空間内に登場する標的に対し攻撃を行うゲーム演算を行うゲーム演算手段と、
を含み、前記仮想3次元ゲーム空間のゲーム画面をディスプレイ上に表示する3次元ゲーム装置において、
前記ゲーム演算手段は、
前記仮想3次元ゲーム空間内における前記標的の座標位置を基準として、前記標的に対し異なるランクのダメージ量を規定する複数のダメージエリアを設定するダメージエリア設定手段と、
前記標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかに基づき、前記標的の受けるダメージを演算するダメージ演算手段と、
を含み、標的のダメージ量に基づいたゲーム演出を行うことを特徴とする3次元ゲーム装置。

【請求項2】　請求項1において、
前記ゲーム用操作手段は、
所定の攻撃アイテム発射用のトリガ操作手段を含み、ゲーム空間内に登場する標的に向け攻撃用アイテムを発射するよう形成され、
前記ダメージ演算手段は、
前記攻撃用アイテムの標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする3次元ゲーム装置。

【請求項3】　請求項2において、
前記ダメージ演算手段は、
前記攻撃用アイテムの移動経路が、どのランクの前記ダメージエリアを通過するかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする3次元ゲーム装置。

【請求項4】　請求項2，3のいずれかにおいて、
前記ダメージ演算手段は、
前記攻撃用アイテムの爆発時の効力エリアが、どのランクの前記ダメージエリアまで達するかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする3次元ゲーム装置。

【請求項5】　請求項1～4のいずれかにおいて、
前記ダメージエリア設定手段は、
ダメージ量の小さなダメージエリアに、ダメージ量の大きなダメージエリアが内包され、標的の基準位置に近づくほどダメージ量が大きくなるように、前記複数ランクのダメージエリアを設定したことを特徴とする3次元ゲーム装置。

【請求項6】　請求項5において、
前記ダメージ演算手段は、
[illegible]
攻撃位置が、どのランクの前記ダメージエリアに含まれるかを判断することを特徴とする3次元ゲーム装置。

【請求項7】　請求項1～6のいずれかにおいて、
前記ダメージエリア設定手段は、
前記各ダメージエリアを、直方体形状に設定することを特徴とする3次元ゲーム装置。

【請求項8】　請求項1～6のいずれかにおいて、
前記ダメージエリア設定手段は、
前記各ダメージエリアを、球形状に設定することを特徴とする3次元ゲーム装置。

【請求項9】　請求項2～8のいずれかにおいて、
前記ゲーム演算手段は、
前記ゲーム用操作手段からの入力信号に基づき、3次元ゲーム空間内をプレーヤ移動体が移動し、前記トリガ操作手段からの操作信号に基づき、プレーヤ移動体からゲーム空間内に登場する移動標的または静止標的に向け攻撃用アイテムを発射するよう形成されたことを特徴とする3次元ゲーム装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、ディスプレイ上に表示される仮想3次元ゲーム空間のゲーム画面を見ながら、3次元ゲーム空間内に登場する標的に対し攻撃を行ないゲームを楽しむ3次元ゲーム装置に関する。

【0002】

【従来の技術】従来より、ディスプレイ上に表示されるゲーム画面を見ながら、仮想3次元ゲーム空間内で、プレーヤが戦闘機などのプレーヤー移動体を操縦し、敵戦闘機などの標的を攻撃するシューティングゲーム装置が知られている。

【0003】この3次元ゲーム装置では、プレーヤの撃った弾が、標的に対応して設定された所定のヒットエリアに命中すると、標的がダメージを受ける画面が表示され、プレーヤに得点が加算されたりする。

【0004】

【発明が解決しようとする課題】この種のゲーム装置では、プレーヤの撃った弾と敵戦闘機等の標的との命中判定（以下ヒットチェックという）をどのようにして行うか、そしてあたり具合によって相手に与えるダメージをいかに演出するかが、ゲームの面白さを左右する重要な要因となる。ラフなヒットチェックでどこに当たっても被弾演出が同じではゲームの面白さが半減してしまう。

【0005】しかし、従来の3次元ゲーム装置は、標的のどこに命中しても一定のダメージがあたえられる設定になっているもののみで、当たる場所によって相手の受けるダメージが異なるように構成されていない。このため、弾がどこにあたったかによって異なった被弾演出が出来ない。

【0006】特に、3次元空間内での戦闘では、実際の[illegible]

ら、いろいろな方向から攻撃を行うため、この面では、プレーヤにとって極めてリアリティの高いものとなるが、プレーヤの操作が被弾演出に詳細に反映されず、極めてラフな被弾演出しかなされていないため、これが原因となって、ゲームのリアリティを損ね、ゲーム演出の面白さを低下させるという問題があった。

【0007】本発明は、このような課題に鑑みてなされたものであり、その目的は、3次元ゲーム空間内に登場する標的に対し攻撃を行うゲームにおいて、プレーヤの操作をダメージ演出に詳細に反映し、リアリティの高い面白いゲームが可能な3次元ゲーム装置を提供することにある。

【0008】

【課題を解決するための手段および作用】前記目的を達成するため、請求項1の発明は、プレーヤの操作するゲーム用操作手段と、前記操作手段からの入力信号及び所定のゲームプログラムに基づき、3次元ゲーム空間内に登場する標的に対し攻撃を行うゲーム演算を行うゲーム演算手段と、を含み、前記仮想3次元ゲーム空間のゲーム画面をディスプレイ上に表示する3次元ゲーム装置において、前記ゲーム演算手段は、前記仮想3次元ゲーム空間内における前記標的の座標位置を基準として、前記標的に対し異なるランクのダメージ量を規定する複数のダメージエリアを設定するダメージエリア設定手段と、前記標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかに基づき、前記標的の受けるダメージを演算するダメージ演算手段と、を含み、標的のダメージ量に基づいたゲーム演出を行うことを特徴とする。

【0009】請求項1の発明によれば、標的が攻撃によってうけるダメージの大きさを決定するために、ダメージエリア設定手段は、仮想3次元空間内の標的の座標位置を基準として、標的に対し異なるランクのダメージ量を規定する複数のダメージエリアを設定しており、ダメージ演算手段は標的に対する攻撃位置が、どのランクのダメージエリアに含まれるかに基づき、標的の受けるダメージを演算している。

【0010】したがって、本発明によれば、仮想3次元空間内において体積を持った標的は、そのいづれの場所に攻撃をうけたかによって、受けるダメージの大きさが異なる演出が可能となり、よりリアリティに富んだゲーム演出を行うことができるゲーム装置を提供することができる。

【0011】前記目的を達成するため、請求項2の発明は、請求項1において、前記ゲーム用操作手段は、所定の攻撃アイテム発射用のトリガ操作手段を含み、ゲーム空間内に登場する標的に向け攻撃用アイテムを発射するよう形成され、前記ダメージ演算手段は、前記攻撃用アイテムの標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする。

【0012】請求項2の発明によれば、ダメージ演算手段は、プレーヤのトリガ操作手段の入力に基づき演算される攻撃位置が標的のどのランクのダメージエリアに含まれるかを検出して、標的の受けるダメージ量を演算している。

【0013】したがって、本発明によれば、標的の受ける攻撃位置によって標的に与えるダメージの演出を変えることが可能となり、よりリアリティに富んだゲーム演出を行うことができるゲーム装置を提供することができる。

【0014】前記目的を達成するため、請求項3の発明は、請求項2において、前記ダメージ演算手段は、前記攻撃用アイテムの移動経路が、どのランクの前記ダメージエリアを通過するかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする。

【0015】請求項3の発明によれば、ダメージ演算手段は、プレーヤのトリガ操作手段の入力に基づき演算される弾道が、標的のどのランクのダメージエリアを通過するかを検出して、標的の受けるダメージ量を演算している。

【0016】したがって、弾が標的のどの位置に当たったかによって標的に与えるダメージの演出を変えることが可能となり、よりリアリティに富んだゲーム演出を行うことができるゲーム装置を提供することができる。

【0017】また、請求項4の発明は、請求項2，3のいずれかにおいて、前記ダメージ演算手段は、前記攻撃用アイテムの爆発時の効力エリアが、どのランクの前記ダメージエリアまで達するかに基づき、前記標的の受けるダメージを演算するよう形成されたことを特徴とする。

【0018】請求項4の発明によれば、ダメージ演算手段は、攻撃用アイテムのその移動経路上での爆発が被害を与えるエリアが、標的のどのランクのダメージエリアまで達するかを検出して、標的の受けるダメージ量を演算している。

【0019】したがって、攻撃用アイテムが爆発したとき、標的がどの位置にいたかによって標的に与えるダメージの演出を変えることが可能となり、よりリアリティに富んだゲーム演出を行うことができるゲーム装置を提供することができる。

【0020】また、請求項5の発明は、請求項1～4のいずれかにおいて、前記ダメージエリア設定手段は、ダメージ量の小さなダメージエリアに、ダメージ量の大きなダメージエリアが内包され、標的の基準位置に近づくほどダメージ量が大きくなるように、前記複数ランクのダメージエリアを設定したことを特徴とする。

【0021】請求項5の発明によれば、基準位置を標的の中心に設けることにより、中心に近い所に被害を受けた場合は大きなダメージをうけ、標的の端部に被害を受

けたときは小さなダメージを受けるような演出が可能となる。

【0022】また前記移動体又は前記弾と他の移動体又は物体の衝突判定の場合は、まともにぶつかったのか、かすったのかによってダメージの度合いを変えることができる。

【0023】また、請求項6の発明は、請求項5において、前記ダメージ演算手段は、ダメージ量の小さいランクから順に、前記標的に対する攻撃位置が、どのランクの前記ダメージエリアに含まれるかを判断することを特徴とする。

【0024】請求項5のようにダメージエリアを設定した場合、ダメージ量の小さなダメージエリアに、ダメージ量の大きなダメージエリアが内包される。従って、外側のダメージエリアから順に、攻撃位置が含まれるかどうか判断していけば、ダメージが大きくなるに従って、判断回数が増え、演算量も増える。このようにすると、ダメージ量が小さい場合には演算量が少なくてすみ、無駄のない演算で判断を行うことができる。

【0025】また、請求項7の発明は、請求項1～6のいずれかにおいて、前記ダメージエリア設定手段は、前記各ダメージエリアを、直方体形状に設定することを特徴とする。

【0026】請求項7の発明のようにダメージエリア設定手段が各ダメージエリアを設定すれば、ダメージエリア判定手段は、仮想3次元空間内の攻撃位置又は命中位置又は爆発時の効力エリアを表す座標が、直方体形状の各ランクのダメージエリアに含まれるか否か検出することによって、ダメージ量を判定する。従って、この直方体形状の各ランクのダメージエリアの中心を標的中心に設定すれば、ダメージエリア判定手段が行う判定のための演算は座標の加減演算のみでよく、少ない演算量でダメージ判定を行うことができる。

【0027】また、請求項8の発明は、請求項1～6のいずれかにおいて、前記ダメージエリア設定手段は、前記各ダメージエリアを、球形状に設定することを特徴とする。

【0028】請求項8の発明のようにダメージエリア設定手段が各ダメージエリアを設定すれば、ダメージエリア判定手段は、仮想3次元空間内の攻撃位置又は命中位置又は爆発時の効力エリアを表す座標が、球形状の各ランクのダメージエリアに含まれるか否か検出することによって、ダメージ量を判定する。従って、この球形状の各ランクのダメージエリアの中心を標的中心に設定すれば、標的中心からの距離を反映したダメージ判定を行うことができる。

【0029】請求項9の発明は、請求項2～8のいずれかにおいて、前記ゲーム演算手段は、前記ゲーム用操作手段からの入力信号に基づき、3次元ゲーム空間内をプ[illegible]信号に基づき、プレーヤ移動体からゲーム空間内に登場する移動標的または静止標的に向け攻撃用アイテムを発射するよう形成されたことを特徴とする。

【0030】請求項9の発明によれば、プレーヤがゲーム用操作手段を操作することにより仮想3次元空間内を移動しながら敵を攻撃して、その攻撃に応じた被害を敵にあたえるゲーム演出を行うゲーム装置を提供することができる。

【0031】

【実施例】次に本発明の好適な実施例を図面に基づき詳細に説明する。

【0032】図1には、本発明が適用された業務用ビデオゲーム装置の好適な一例が示されている。実施例のビデオゲーム装置は、コックピット部10と、その前方に配置されたディスプレイ30とを有する。

【0033】前記コックピット部10は、戦闘機の操縦室を想定して形成されている。シート12に座ったプレーヤは、コイン投入部18から所定のコインを投入し、スタートボタン20を操作するとゲームがスタートし、ディスプレイ30上には、ゲーム画面300が表示される。このゲーム画面300には、後述するよう予め設定された3次元ゲーム空間内において、コックピット部10の正面に見える景色が表示される。この3次元ゲーム空間内には、敵の戦闘機532が飛行している。なお、初心者には自機が見える映像のほうが操作しやすいので、自機の後方斜め上から見た景色が表示されるようにしてもよい。

【0034】図2に示すよう、このコックピット部10には、操縦装置として、操縦レバー14と、スピードレバー16とが設けられている。前記操縦レバー14は、前後に倒すことにより戦闘機を下または上向き（y軸方向）へ制御し、左右方向に倒すことにより戦闘機を右または左方向（x軸方向）へ旋回するように制御するものである。さらに、スピードレバー16は、これを操作することにより前方向（z軸方向）へのスピードを制御するものである。プレーヤは、操縦レバー14を操作して自分の戦闘機の姿勢および向き制御し、スピードレバー16を操作して自分のスピードを制御し、敵の戦闘機532を追跡したり、地上の敵基地を探し出す。そして、ゲーム画面300に現れる敵戦闘機532や敵基地等の標的にに照準320を合わせ、トリガボタン22，24を操作してマシンガン、ミサイルを発射し標的を撃破し得点を上げる。

【0035】図3には、実施例の業務用ビデオゲーム装置の機能ブロック図が示されている。

【0036】実施例の業務用ビデオゲーム装置は、プレーヤ操作部40と、ゲーム演算部100と、画像合成部200と、ディスプレイ30とを含む。

【0037】前記プレーヤ操作部40は、図2に示す各[illegible]

等のプレーヤの操作する部材である。その操作信号は、ゲーム演算部１００へ入力される。

【００３８】ゲーム演算部１００は、操作部４０からの入力信号と、あらかじめ定められたゲームプログラムとに基づき、各種のゲーム演算を行い、画像合成に必要なデータを画像合成部２００へ出力するものであり、ゲーム空間演算部１１０、マップ情報記憶部１３０、移動体情報記憶部１４０を含んで構成される。

【００３９】３次元空間を構成するオブジェクトには戦闘機などの移動するものと、地面、山、敵基地、川などの位置が固定のものがある。

【００４０】移動体情報記憶部１４０には、敵戦闘機等の移動体の位置情報・方向情報及びこの位置に表示すべき敵戦闘機等の映像を表すオブジェクトのオブジェクトナンバーが記憶されている（以下、この記憶された位置・方向情報及びオブジェクトナンバーを移動体情報と呼ぶ）。

【００４１】また、マップ情報記憶部１３０には、地面、山、敵基地、川等からなるマップ情報が方形状に分割され、この分割されたマップの位置情報及びこの位置に表示すべき地面・山等の映像を表すオブジェクトのオブジェクトナンバーが記憶されている（以下、この記憶された位置情報及びオブジェクトナンバーを分割マップ情報と呼ぶ）。

【００４２】ゲーム空間演算部１１０内に設けられた記憶部（図示せず）には、所定のゲームプログラムが記憶されている。ゲーム空間演算部１１０は、このゲームプログラム及び操作部４０からの操作信号及び移動体情報記憶部１４０から読み出した自機戦闘機情報にしたがって自機戦闘機の位置座標を演算する。さらにゲーム空間演算部１１０は、ゲームプログラム及び移動体情報記憶部１４０から読み出した移動体情報に基づいて、他の移動体の位置座標も演算する。そして自機戦闘機の位置座標、他の移動体の位置座標、マップ情報記憶部１３０から読み出した分割マップ情報に基づいて、ゲーム空間を設定する。

【００４３】このようにして本実施例では図４（Ａ）に示すよう設定された所定の３次元ゲーム空間内をプレーヤの操縦により戦闘機が移動し、プレーヤが敵の戦闘機を攻撃する様子を演算し、演算結果を画像合成部２００に出力する。

【００４４】本実施例のゲーム装置では１／６０秒ごとにディスプレイに画像が供給されるので、ゲーム空間演算部１１０は１／６０秒ごとに各移動体のワールド座標系における位置座標を演算して、画像合成部２００に出力している。

【００４５】なお、このゲーム空間演算部１１０の命中判定部１２０おける演算処理の詳細は後述する。

【００４６】画像合成部２００は、ゲーム演算部１００の演算結果に従い、実際にプレーヤから見える疑似３次元画像の形成を行い、ディスプレイ３０上に表示するものであり、３次元演算部２２０と、画像描画部２４０と、オブジェクト画像情報記憶部２６０とを含んで構成される。

【００４７】前記オブジェクト画像情報記憶部２６０には、前記のオブジェクトナンバーにより指定された敵戦闘機などの移動体の画像情報と、地面、山、敵基地等の画像情報とが記憶されている。

【００４８】この場合、これらの画像情報は複数のポリゴンの集合として表現されている。例えば図５に示すように、敵戦闘機等の移動体オブジェクト５１０はポリゴン５１２－１，５１２－２，～５１２－５…の集合により表現されている。そして、このポリゴン５１２－１～５１２－５…の各頂点座標等からなる画像情報が、オブジェクト画像情報記憶部２６０に記憶されている。同様に、マップオブジェクトである敵基地等のマップ情報も、ポリゴンの集合として表現され、このポリゴンの頂点座標等からなる画像情報もオブジェクト画像情報記憶部２６０に記憶されている。

【００４９】３次元演算部２２０は、入力されたデータ（移動体情報や分割マップ情報）に基づき、オブジェクト画像情報記憶部２６０から対応する画像情報を読み出し、複数のポリゴンの集合としてゲーム空間へ設定する。このときワールド座標系で入力された各オブジェクトの位置情報より、各オブジェクトを構成するポリゴンの集合の視点座標系における頂点座標を求める処理を行う。すなわちゲーム空間演算部の出力座標はワールド座標系なので視点座標系へ座標変換を行う。そして視野外にあるデータを除去するクリッピング処理、スクリーン座標系への透視投影変換及びソーティング処理等の処理をおこなって、画像描画部２４０へ処理後のデータを出力する。

【００５０】画像描画部２４０では、これらの入力されたデータから実際にプレーヤから見えるべき画像情報の形成を行う。つまり、３次元演算部２２０から入力されたデータは、ポリゴンの頂点情報等から構成される画像情報として表現されているため、画像描画部２４０では、このポリゴンの頂点情報等からポリゴン内部全てのドットにおける画像情報の形成が行われる。そして、処理後のデータは、ディスプレイ３０に出力され、図４（Ｂ）に示すような仮想３次元画像が形成されることになる。

【００５１】なお、画像描画部２４０における画像合成の演算手法としては、ポリゴンの頂点座標からポリゴンの輪郭線を求め、この輪郭線と走査線との交点である輪郭点ペアを求め、この輪郭点ペアにより形成されるラインを所定の色データ等に対応させるという手法を用いてもよい。また、各ポリゴン内の全てのドットの画像情報を、テクスチャ情報としてあらかじめＲＯＭ等に記憶させておき、ポリゴンの各頂点に与えられたテクスチャ座

標をアドレスとして、これを読み出し、はり付けるというテクスチャマッピングと呼ばれる手法を用いてもよい。

【0052】図6には、画像合成手法の原理図が示されている。

【0053】実施例のゲーム装置には、3次元ゲーム空間500内のマップ情報及びこの3次元ゲーム空間500内に登場する3次元オブジェクト510に関する情報があらかじめ、ゲーム演算部100内のマップ情報記憶部130及び移動体情報記憶部140に記憶されている。

【0054】また前記3次元オブジェクト510に関する画像情報は、複数のポリゴン512－1，512－2，512－3，……からなる形状モデルとして表現され、あらかじめオブジェクト画像情報記憶部260に記憶されている。

【0055】本実施例の戦闘機ゲームを例に取ると、3次元オブジェクト510は3次元ゲーム空間500内に登場する戦闘機532等であり、3次元ゲーム空間500内には、この他に、例えば、図4に示すように地面519、山520、ビル522、陣地524、などの背景を表す各種の3次元オブジェクトが配置されている。

【0056】これらの3次元オブジェクトは、画像合成部200で仮想プレーヤPの視点610を中心とする視点座標系の透視投影面620上に透視投影変換され、疑似3次元画像522としてディスプレイ30上に表示される。

【0057】図7には、3次元ゲーム空間500内におけるプレーヤの操縦する戦闘機530と、敵の戦闘機532との位置関係が示されている。3次元ゲーム空間500は、原則としてワールド座標系（XW，YW，ZW）で表されるが、同図では、プレーヤの操縦する戦闘機530の操縦席の位置に、図6に示す視点610を設定した視点座標系で表されている。この視点座標系は、視点610の視線の方向をz軸、左右方向をx軸，上下方向をy軸と定義し、自機530の移動とともに移動する。従って、プレーヤが操作部40を前にして、視点610からディスプレイ30を見ると、自分が戦闘機のコックピットに座り、3次元ゲーム空間500内に位置しているような映像を見ることができる。

【0058】プレーヤが、操作レバー14等を操作して、自分が仮想的に乗っている戦闘機の回転、並進等の操作を行うと、3次元ゲーム空間500に対する視点610の位置が変化し、3次元ゲーム空間500が回転、並進されることになる。このためゲーム演算部100は、この操作信号およびゲームプログラムに基づいて3次元ゲーム空間500を構成する、戦闘機である3次元オブジェクト510やその他の3次元オブジェクトの回転、並進等の演算をリアルタイムで行う。そして、画像合成して、これらの[illegible]トは透視投影面620上に透視投影変換され、リアルタイムで変化する疑似3次元画像522としてディスプレイ30上に表示される。

【0059】コンピュータグラフィックスの手法を用いた場合、前記3次元オブジェクト510は、独立したボディ座標系を用いてその形状モデルを作成している。すなわち、3次元オブジェクト510を構成する各ポリゴンを、このボディ座標系上に配置し、その形状モデルを特定している。

【0060】さらに、3次元ゲーム空間500は、ワールド座標系（XW，YW，ZW）を用いて構成され、ボディ座標系を用いて表された3次元オブジェクト510は、その運動モデルに従ってワールド座標系の中に配置される。

【0061】そして、視点610の位置を原点として、視線の方向をz軸の正方向にとった視点座標系にデータを変換し、投影面620であるスクリーン座標系へ、それぞれの座標を透視投影変換する。このようにして、視点610から見える3次元ゲーム空間500の視野内の画像をディスプレイ30上に表示することができる。したがって、プレーヤは、レバー14，16やトリガ釦22，24を操作することにより、3次元ゲーム空間500内を戦闘機を操縦しながら敵機を攻撃している状態を仮想シュミレートできることになる。

【0062】実施例の業務用ゲーム装置において、ゲームが開始されると、プレーヤの操縦する戦闘機は図4に示す仮想3次元ゲーム空間500を自由に飛び回り、敵機、敵基地等をバルカン砲やミサイルで攻撃する。

【0063】図8は、3次元ゲーム空間500を、視点座標系のx，zの2次元空間として表したものである。同図において、560はプレーヤの操縦する戦闘機の視界範囲であり、564は敵影視認距離、562はバルカン有効射程距離、566はミサイル最大射程である。

【0064】従って、ミサイル最大射程566、バルカン有効射程距離562に含まれない敵戦闘機に向け、ミサイルやバルカン砲を発射しても、敵戦闘機を効果的に攻撃はできない。

【0065】図9には、ディスプレイ30に表示されるゲーム画面の、より詳細な一例が示されている。実施例のゲーム装置は、3次元ゲーム空間500内の視界範囲560内に敵戦闘機532が位置し、しかも、その位置が、図8に示す敵影視認距離564より手前に位置する場合にのみ、その敵戦闘機532の画像をゲーム画面上に表示するよう形成されている。そして、敵戦闘機532の表示位置に、ターゲットディシグネータ310aを重ねて表示する。このターゲットディシグネータ310aは、敵戦闘機532の位置を示すものであり、敵戦闘機532はその円の中心に位置する。従って、プレーヤはこのターゲットディシグネータ310aにより、ゲーム画面560内に存在する敵戦闘機532を確実に確認

することができる。

【００６６】さらに、敵戦闘機５３２が、ミサイルレンジサークル３２４内に入ると、ミサイルシーカ３２２が自動的に表示され、敵戦闘機５３２へ向け移動を開始する。そして、このミサイルシーカ３２２が、ターゲットディシグネータ３１０ａと重なると、敵戦闘機５３２にミサイルがロックオンされた状態となる。この状態で、プレーヤがミサイル発射用のトリガボタン２４を操作すると、図１１に示すようミサイル５８２が発射され、敵戦闘機５３２に対する追尾を開始する。通常は、このミサイル５８２は、敵戦闘機５３２を自動追尾し、敵戦闘機５３２に命中することになるが、場合よってはこのミサイル発射をゲーム演算部１００が検出し、図１１に示すよう、敵戦闘機５３２からチャフ３１２を放出するゲーム演出を行う場合がある。

【００６７】このチャフ３１２により、ミサイル５８２が撹乱されるか否かは確率により、さらにこの確率はゲームレベルに依存する。撹乱された場合、ミサイル５８２はチャフ３１２を目標に図１１（Ａ），（Ｂ），（Ｃ）に示すように順次追尾し、チャフ３１２のポイントで爆発する。

【００６８】また、図８に示すバルカン有効射程距離５６２の範囲内に、敵戦闘機５３２が位置すると、図９に示すようゲーム画面３００の中央にバルカン砲照準３２０が表示される。このバルカン砲照準３２０を用いて敵戦闘機５３２に照準を合わせ、バルカン砲用のトリガボタン２２を操作することにより、図１０に示すよう敵戦闘機５３２へ向けバルカン砲を発射し、これを撃墜することができる。

【００６９】なお、このゲーム画面３００の左隅には、敵戦闘機５３２の位置を表示するレーダー３４０、右下隅には保有する攻撃用アイテム３５０の残数表示が行われ、右上隅には、ゲーム残り時間３３０が表示される。

【００７０】また、本実施例のゲーム装置には、前記バルカン砲や、ミサイルの命中判定動作を行うため、ゲーム空間演算部１１０に、命中判定部１２０が設けられている。

【００７１】この命中判定部１２０は、プレーヤの戦闘機５３０から発射されたバルカン砲の弾５８０やミサイル５８２の位置P_2と、標的である敵戦闘機５３２の位置P_1とを比較し、その命中判定を行うように構成されている。

【００７２】そして、バルカン砲やミサイルが敵に命中すると、爆発等の演出を視覚的、聴覚的に行うように構成されている。

【００７３】ところで、この種のゲームでは、プレーヤの撃った弾と標的とのヒットチェック動作をどのようにして行うか、そして当たり具合によって相手に与えるダメージをいかに演出するかがゲームの面白さを左右する大きな要因となる。ラフなヒットチェックでは、ゲームの面白さが半減してしまう。

【００７４】このため、実施例の命中判定部１２０は、３次元ゲーム空間５００内における敵の座標位置P_1を基準として、前記標的に対し異なるランクのダメージ量を規定する複数のダメージエリアを設定するダメージエリア設定部１２２と、前記標的に対する攻撃位置が、どのランクのダメージエリアに含まれるかに基づき、標的におけるダメージを演算するダメージ演算部１２４とを含むように構成されている。

【００７５】図１２（Ａ）には、敵戦闘機５３２に対するダメージエリアの具体例が示されている。実施例では、前記ダメージエリアとして、機体中心を中心とする複数の立方体を第一，第二のヒットチェックボックス７００，７１０として設定し、ダメージ判定を行うように形成されている。ここにおいて、第二のヒットチェックボックス７１０は小さく、第一のヒットチェックボックス７００は大きく形成され、第二のヒットチェックボックス７１０は第一ヒットチェックボックス７００に内包されるように設定されている。なお、第一のヒットチェックボックス７００は、射撃を容易にするため、実際の敵戦闘機５３２のサイズより大きめに設定されている。そして、中心側に位置する第二のヒットチェックボックス７１０に対しては、大きなダメージ量が設定され、外側に位置する第一のヒットチェックボックス７００には相対的に小さなダメージ量が設定されている。

【００７６】このように、実施例のダメージエリア設定部１２２は、ダメージ量の小さなヒットチェックボックス７００に、ダメージ量の大きなヒットチェックボックス７１０が内包され、標的である敵戦闘機５３２の中心位置P_1に近づく程ダメージ量が大きくなるように、前記各ヒットチェックボックス７００，７１０のランク設定を行っている。

【００７７】また、前記ダメージ演算部１２４は、攻撃用アイテムの標的である敵戦闘機５３２に対する攻撃位置が、どのランクのヒットチェックボックスに含まれるかに基づき、標的である敵戦闘機５３２のダメージを演算するよう形成されている。本実施例において、攻撃用アイテムとしてバルカン砲を用いた場合と、ミサイルを用いた場合とでは、そのダメージ判定が若干異なる。

【００７８】図１２（Ｂ）には、バルカン砲を用いた場合のダメージ判定動作が示され、同図（Ｃ）にはミサイルを用いた場合のダメージ判定動作が示されている。

【００７９】まず、バルカン砲を用いた場合のダメージ判定動作を説明する。図１２（Ｂ）にはバルカン砲で攻撃を受ける敵戦闘機（図示せず）のヒットチェックボックス７００、７１０が示されている。プレーヤが敵戦闘機（図示せず）に向けバルカン砲を発射し、その弾丸５８０の軌跡が、同図に示すよう５８０－１，５８０－２…５８０－３の順に移動する場合を想定する。このとき、前記ダメージ演算部１２４は、弾丸５８０の移動経

路が、どのランクのヒットチェックボックスを通過するかに基づき、標的である敵戦闘機５３２におけるダメージを演算する。例えば、弾丸５８０の移動経路が、各ヒットチェックボックス７００，７１０の何れも通過しない場合には、弾丸は外れたと判断され、ダメージの演算は行われない。

【００８０】また、弾丸５８０の移動経路が、第一のヒットチェックボックス７００を通過すると、ダメージ演算部１２４は、弾丸の軌跡が次に第二のヒットチェックボックス７１０を通過するか否かの判断を行う。第二のヒットチェックボックス７１０を通過しないと判断された場合には、第一のヒットチェックボックス７００のみを通過したと判断し、小さなダメージ量の演算設定が行われる。第二のヒットチェックボックス７１０を通過する判断された場合には、敵戦闘機５３２の機体のより中心に近い部分に命中したと判断され、大きなダメージ量の演算設定が行われる。

【００８１】また、前記ダメージ演算部１２４は、敵戦闘機５３２へむけミサイル５８２が発射された場合にも、原則としてバルカン砲のヒットチェック動作と同様にダメージ演算が行われる。すなわち、前記ミサイル５８２は、敵戦闘機５３２に命中すると、命中位置で爆発するようにゲーム演算が行われる。そして、その爆発が、前記第一および第二のヒットチェックボックスの何れに属するかに基づき、異なるダメージ量の演算設定が行われる。

【００８２】また、前記ミサイル８２には、爆発半径の概念も設定されている。例えば、図１１に示すよう、敵戦闘機５３２がチャフ３１２を投下し、ミサイルがこのチャフ３１２に衝突して爆発した場合には、爆発位置は第一および第二のヒットチェックボックス７００，７１０のいずれにも含まれないことになる。

【００８３】この場合でも、この爆発位置から、ｒの半径内に第一，第二のヒットチェックボックス７００，７１０のいずれかが存在するかが判断され、ダメージ量の演算設定が行われる。

【００８４】なお、当然のことながら、同一のヒットチェックボックスにバルカン砲や、ミサイルが命中した場合には、バルカン砲に比べミサイルの方のダメージは大きく、設定される。また、同じミサイルが爆発した場合でも、ミサイル５８２が、前記ヒットチェックボックス内で爆発した場合に比べ、図１２（Ｃ）に示すようヒットチェックボックスの外で爆発した場合には、そのダメージ量は小さく設定されることは言うまでもない。

【００８５】そして、実施例のゲーム空間演算部１１０は、ミサイルやバルカン砲が敵に命中すると、大小の爆発や発煙などの被弾の演出を、視覚的、聴覚的に行う。

【００８６】また敵戦闘機５３２は、以前に受けたダメージの大きさで決定される耐久力を有しており、以前に受けたダメージが大きいほど[illegible]ている。従って、一度被弾して耐久力の衰えた敵機と、まだ被弾していない敵とでは、次に同じ様な被弾を受けた場合でも異なる被弾演出が行われ、よりリアリティの高いゲーム画面が表示されることになる。

【００８７】図１４は、敵機の被弾の様子を表示したゲーム画面である。同図（Ａ）から順に、同図（Ｅ）に従って、大きなダメージを受けた場合の演出画面が示されている。

【００８８】敵機は、ミサイル、バルカンによりダメージを与えられると、ダメージ量に応じた被弾の演出が行われる。被弾した敵は、ダメージ量に応じて性能が低下し、回転運動などが鈍化する。

【００８９】ダメージ量が少ない場合には、同図（Ａ）に示すよう、白色系の煙を少量出すような演出が行われる。ダメージが増加すると、同図（Ｂ）に示すよう、火災が発生するような演出がなされる。

【００９０】ダメージが一定量を越えたところで、同図（Ｃ）に示す小爆発、同図（Ｄ）に示す中爆発の演出が行われる。小、中爆発は基本的にランダムに起こるが、コース選択、ステージ、残り時間、敵の強さなどの状況により、その確率は変動する。

【００９１】そして、敵の耐久力がゼロになると、同図（Ｅ）に示す爆発画面が表示される。

【００９２】図１３には、実施例の装置の命中判定動作と、ダメージ演出動作のフローチャートが示されている。

【００９３】なお、説明を簡単にするために、ここではバルカン砲のヒットチェックを行う場合を例にとり説明する。

【００９４】まず、プレーヤは戦闘機５３０を操縦し、敵戦闘機５３２を図１０に示すようバルカン砲照準３２０付近に取らえ、バルカン砲を発射した場合を想定する。

【００９５】図７には、このときプレーヤ戦闘機５３０を視点座標系の原点とした場合における、敵戦闘機５３２の３次元座標位置P_1と、発射されたバルカン砲の弾５８０の３次元座標位置P_2との関係が示されている。

【００９６】ダメージ演算部１２４は、このようにしてバルカン砲が発射されると、発射された弾５８０の現座標位置P_2に基づき、この弾道が図１２（Ａ）に示す敵戦闘機５３２ヒットチェックボックス７００，７１０を通過したかどうかを検出する。

【００９７】図１２（Ｂ）に示すように、弾５８０が５８０－１のように第一のヒットチェックボックス７００の外部にあるときにはまだヒットを検出せず、弾５８０が５８０－２のように第二のヒットチェックボックス７００の内部にきたときヒットを検出する。

【００９８】以下説明のため、第一のヒットチェックボックス７００とのヒットチェックを第一命中判定と呼び、第二のヒットチェックボックス７１０とのヒット

ェックを第二命中判定と呼ぶ。またそれぞれにヒットしたときの出力を、第一の命中信号、第二の命中信号と呼び、はずれたときの出力を第一のはずれ信号、第二のはずれ信号と呼ぶ。

【0099】第一命中判定では、ワールド座標系で表された、弾580の座標P_2とヒットチェックボックス700の中心のX，Y，Z座標データの差を、予め定められた第一命中判定用のX座標及びY座標及びZ座標の各基準値と比較することにより、ヒットチェック動作を行う。ここで機体の中心と第一のヒットチェックボックス700の中心が一致しているので、敵の戦闘機532のX，Y，Z座標データを、第一のヒットチェックボックス700の中心P_1のX，Y，Z座標データとして用いることができる。

【0100】第一のヒットチェックボックス700の中心の座標をP_1（X_1、Y_1、Z_1）、弾580の座標をP_2（X_2、Y_2、Z_2）、第一のヒットチェックボックス700の一辺を$2a_1$とすると、前記第一命中判定用のX座標及びY座標及びZ座標基準値はa_1となり、弾580の座標P_2がこの第一のヒットチェックボックス700の内部にあるとき次の関係が成り立つ。

【0101】

$|X_2 - X_1| \leq a_1$ …　(1)

$|Y_2 - Y_1| \leq a_1$ …　(2)

$|Z_2 - Z_1| \leq a_1$ …　(3)

ゲーム画面は1／60秒ごとにディスプレイに供給されるように構成されているので、ゲーム演算部100は1／60秒ごとに移動体のワールド座標系における座標P_1（X_1、Y_1、Z_1）、P_2（X_2、Y_2、Z_2）の値を演算している。ダメージ演算部124は、トリガ操作により弾が発射されると、弾と各オブジェクトについてその値が上記（1）～（3）の関係を満たすかどうかチェックしており、上記（1）～（3）の関係すべて満たしたとき第一の命中信号を出力する（ステップ10）。

【0102】満たさないときは命中の可能性が無くなるまで1／60秒ごとに前述のヒットチェック動作をくりかえす。命中の可能性の有無は相手が敵戦闘機などの移動体である場合は、今後の弾道と移動を考慮した移動体の位置関係でおこなう。すなわち図12（A）で弾580が580－3の位置に来たときは、以後命中の可能性がないとされる。また移動体でない場合は、今後の弾道が相手から離れると演算された場合、命中の可能性がないとされる。このように、命中の可能性がないとされた場合に、第一のはずれ信号を出力する（ステップ10）。

【0103】なお第一の命中判定では、予め弾道を計算してヒットの可能性のあるオブジェクトのみについて前述のヒットチェック動作を行うとCPUの負荷が軽減する。そして、第一命中判定により第一のはずれ信号が出力され、弾道が敵戦闘機に衝突の可能性がないと判断されると（ステップ12）、通常のゲーム演出が行われる（ステップ22）。

【0104】また、第一命中判定により第一の命中信号が出力され、弾580がヒットチェックボックス700に命中していると判断されると（ステップ12）、次に弾580が第二のヒットチェックボックス710に命中するか否かの第二命中判定が行われる（ステップ14）。

【0105】第二命中判定でも第一命中判定と原理的には同様のヒットチェック動作を行う。ただし第二命中判定は、図12（B）に示すように第一のヒットチェックボックス700を弾580が通過する間の短い時間内に第二のヒットチェックボックス710をも弾580が通過するかどうかチェックするものなので、第一命中判定よりも短いサイクルで前述のヒットチェック動作を繰り返し行っている。すなわち、弾580と敵戦闘機の532の1／60秒ごとの座標値と、その運動状態とにより、1／60秒をさらに短いサイクルに区切って各座標値を求めてヒットチェック動作を行っている。

【0106】ヒットチェックボックス700、710の中心の座標をP_1（X_1、Y_1、Z_1）、このようにして求めた弾580の座標をP_2（X_2、Y_2、Z_2）、ヒットチェックボックス710の一辺を$2a_2$とすると、前記第二命中判定用のX座標及びY座標及びZ座標基準値はa_2となり、弾580の座標P_2がこの第二のヒットチェックボックス710の内部にあるとき次の関係が成り立つ。

【0107】$|X_2 - X_1| \leq a_2$ …　(4)

$|Y_2 - Y_1| \leq a_2$ …　(5)

$|Z_2 - Z_1| \leq a_2$ …　(6)

そしてダメージ演算部124は上記（4）～（6）の関係を全て満たしたとき、第二の命中信号を出力し、満たさないときは命中の可能性が無くなるまで前述のヒットチェック動作をくりかえす。そして、命中の可能性が無いと判断すると、第二のはずれ信号を出力する。

【0108】第二命中判定により第二の命中信号が出力され、弾580が第二のヒットチェックボックス710に命中したと判定されると（ステップ16）、大ダメージ演出（ステップ18）が行われ、図14（B）のような大ダメージ演出画面が表示される。

【0109】第二命中判定により第二のはずれ信号が出力され、第一のヒットチェックボックス700にのみ命中と判断されると（ステップ16）、小ダメージ演出が行われ（ステップ20）、図8（A）のような小ダメージ演出画面が表示される。

【0110】このようにして弾580が大小いづれかのヒットチェックボックス700、710にヒットしたか否かをチェックしており、ヒットチェックボックス710にヒットしたときは相手に大きなダメージを与え、ヒットチェックボックス700のみにヒットしたときは相

手に小さなダメージを与え、それ以外のときは弾５８０は命中していないとしてダメージを与えない。

【０１１１】このように、ヒットチェックボックス７００、７１０を立方体とすると、座標値の加減算と大小判定のみで、ヒットチェックを行うのでデータ処理量を大幅に低減し、ＣＰＵの負担を軽減することができる。また本実施例では立方体としたが、直方体としても効果は同様である。

【０１１２】また、ヒットチェックボックスのサイズによって射撃の難易度がきまるが、本実施例ではヒットチェックボックス７００は射撃難易度緩和のため、実機のサイズより大きめに設定している。したがって初心者でもヒットチェックボックス７００には比較的命中しやすくなり、全く当たらないままゲームが終了してしまうということがすくなくなる。また上級者は、命中の度合いによってダメージ演出が異なるので、自分の腕が正確に反映されたゲームを楽しむことができる。

【０１１３】またゲームの難易度が選択できるような設定の場合には、初心者用の場合は、敵機のヒットチェックボックスを大きめにとり当たりやすくし、自機のヒットチェックボックスを小さめにとり当たりにくくし、上級者用の場合はその反対になるように構成してもよい。

【０１１４】またヒットチェックボックスは機体中心を中心としているので機体の回転をそのまま立方体の回転に利用できるが、ヒットチェックボックス自体を回転させることは、演算負荷が増す割にゲームの見かけ上の視覚的効果が薄いので、本実施例では機体姿勢にあわせての回転は行わず、機体の中心座標にたいして固定にしている。

【０１１５】なお、本発明は前記実施例に限定されるものではなく、本発明の要旨の範囲で各種の変形実施が可能である。

【０１１６】前記実施例では、各ダメージエリアを、立方体形状をしたヒットチェックボックスとして設定する場合を例にとり説明したが、本発明はこれに限らず、必要に応じて各種形状に形成することができる。特に、このダメージエリアは、空間的に演算の容易な３次元形状に設定するが好ましく、例えば、球形状に形成することも可能である。

【０１１７】また、前記各実施例では、ダメージ量の小さなダメージエリアに、ダメージ量の大きなダメージエリアが内包されるようにこの設定を行ったが、本発明はこれに限らず、異なるランクの複数のダメージエリアが隣接するように配置してもよくまたその一部が重複するように設定してもよい。

【０１１８】例えば、エンジン部を別のヒットチェックボックスにしたり、翼部を別のヒットチェックボックスにして異なった演出をしてもよい。

【０１１９】

【発明の効果】以上説明したように、本発明によれば、３次元ゲーム空間に登場する標的に対し攻撃を行うゲームにおいて、プレーヤの操作をダメージ演出に詳細に反映し、リアリティの高い面白いゲームが可能な３次元ゲーム装置を提供できるという効果がある。

【０１２０】

【図面の簡単な説明】

【図１】実施例のゲーム装置の外観斜視図である。

【図２】実施例のゲーム装置の外観斜視図である。

【図３】実施例のゲーム装置の機能ブロック図である。

【図４】実施例の３次元ゲーム空間の概略図とゲーム画面の説明図である。

【図５】ポリゴンの集合で表現された３次元オブジェクトの一例を示す概略図である。

【図６】実施例の２次３次元ゲーム画像の合成原理を説明図である。

【図７】３次元ゲーム空間内におけるプレーヤと標的との位置関係を示す説明図である。

【図８】３次元空間内におけるミサイル最大射程、バルカン有効射程距離などの説明図である。

【図９】実施例のゲーム画面のより詳細な説明図である。

【図１０】バルカン砲で敵を攻撃している時のゲーム画面の説明図である。

【図１１】ミサイルで攻撃された敵戦闘機がチャフフレアを投下した状態を示す説明図である。

【図１２】本実施例のダメージ判定用のヒットチェックボックスの説明図である。

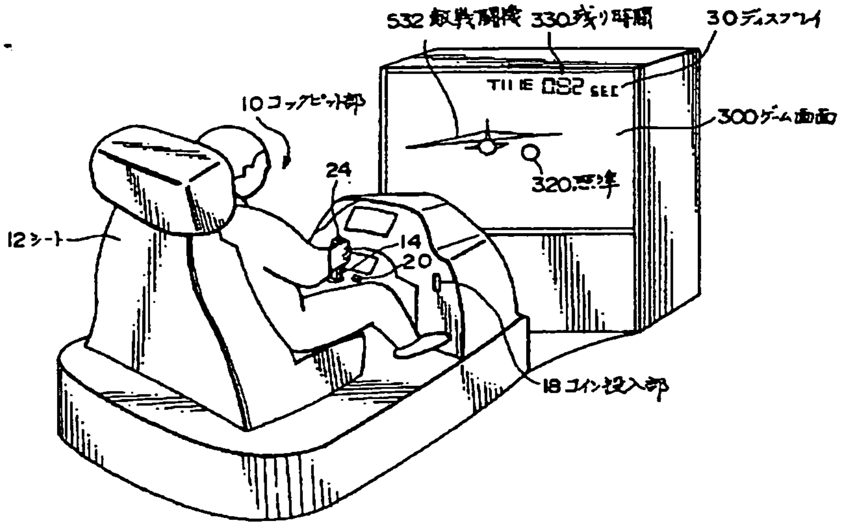
【図１３】実施例の装置の命中判定動作とダメージ演出動作を示すフローチャート図である。

【図１４】敵戦闘機のダメージ演出画面の説明図である。

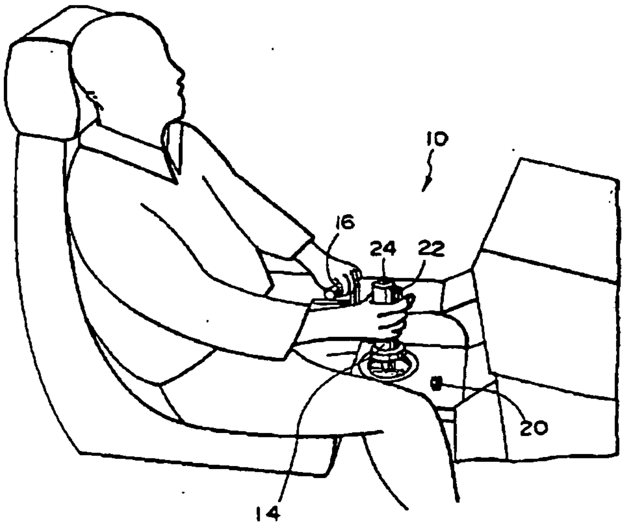
【符号の説明】

３０	ディスプレイ
４０	操作部
１００	ゲーム演算部
１１０	ゲーム空間演算部
１２０	命中判定部
１２２	ダメージエリア設定部
１２４	ダメージ演算部
２００	画像合成部
２２０	３次元演算部
２４０	画像描画部
２６０	オブジェクト画像情報記憶部

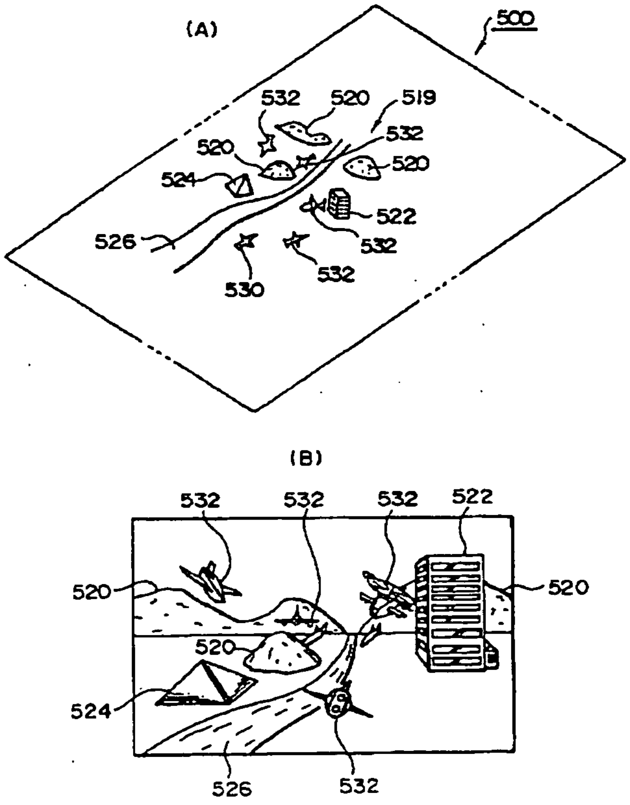
【図1】


532敵戦闘機
330残り時間
30ディスプレイ
TIME 082 SEC
10コックピット部
300ゲーム画面
320照準
24
12シート
14
20
18コイン投入部

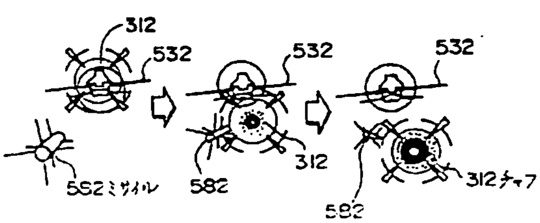
【図2】



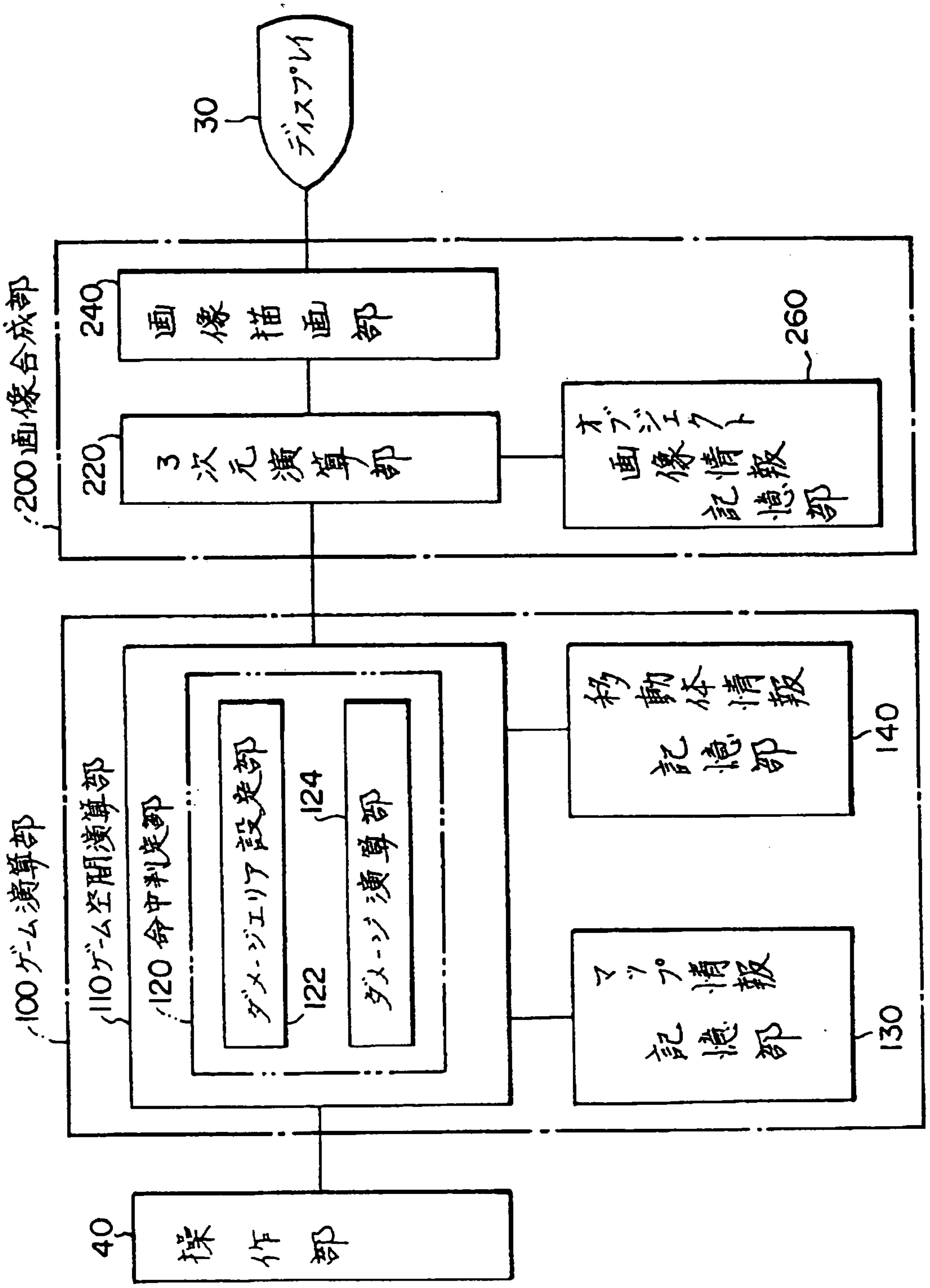
【図4】


(A)
(B)

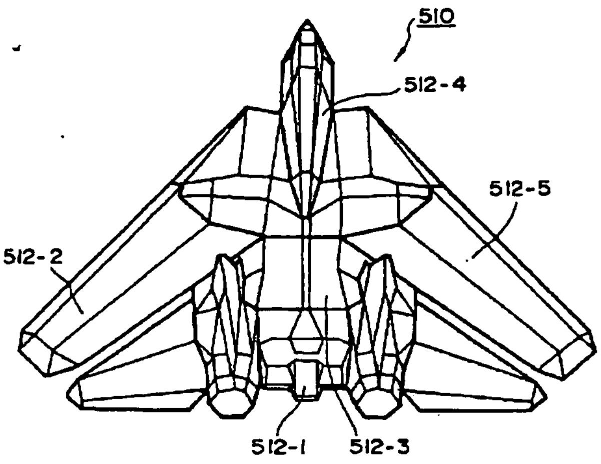
【図11】


(A)
(B)
(C)
312
532
582ミサイル
532
582
312
532
582
312チャフ

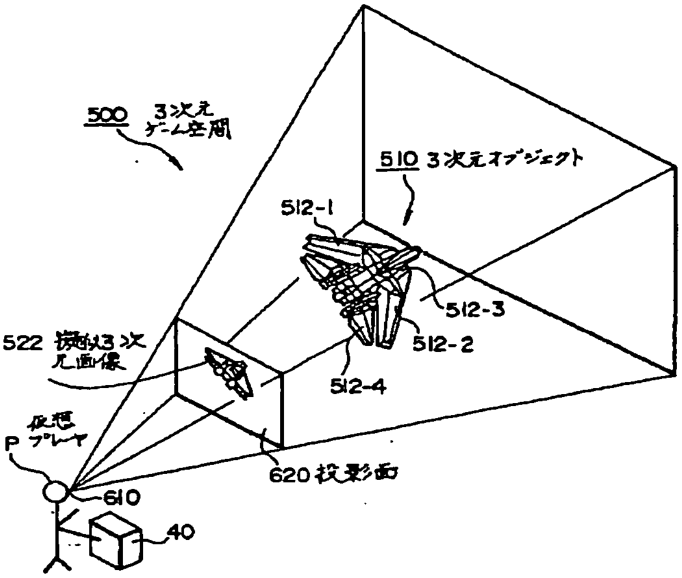
【図３】


30
ディスプレイ
200 画像合成部
240 画像描画部
220 3次元演算部
260 オブジェクト画像情報記憶部
100 ゲーム演算部
110 ゲーム空間演算部
120 命中判定部
122 ダメージエリア設定部
124 ダメージ演算部
140 移動体情報記憶部
130 マップ情報記憶部
40 操作部

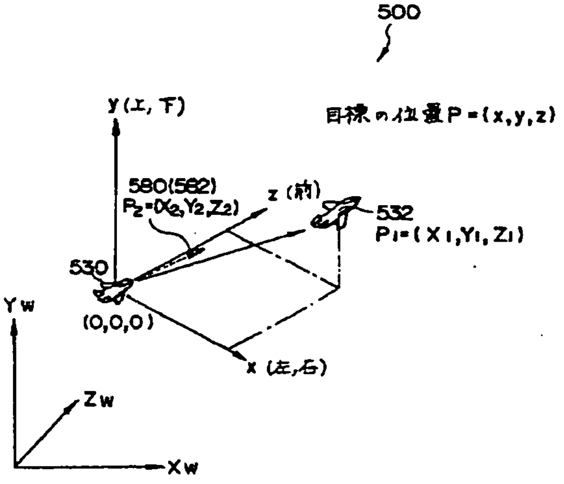
【図5】



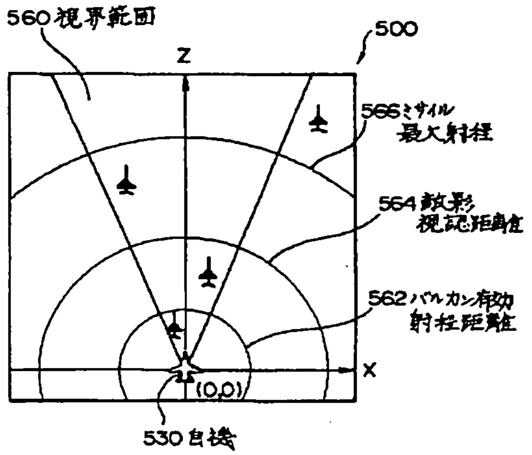
【図6】



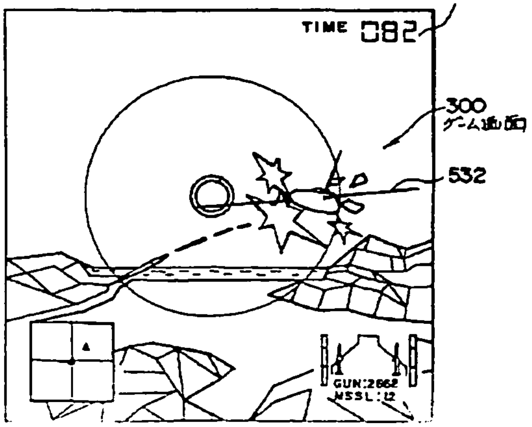
【図7】



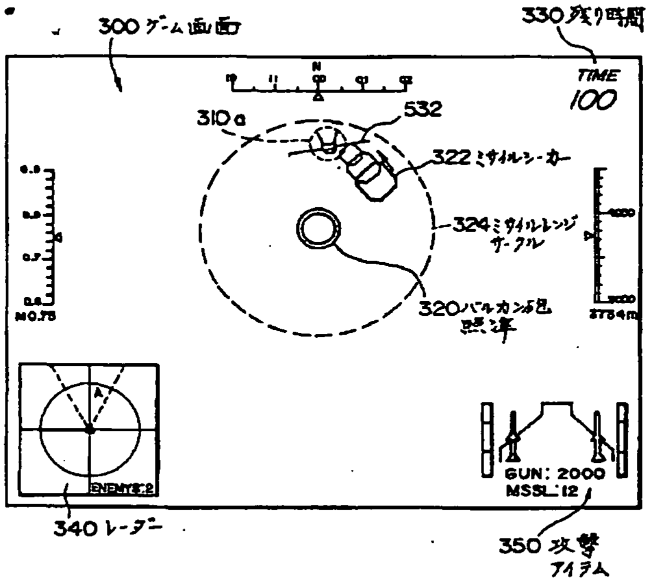
【図8】



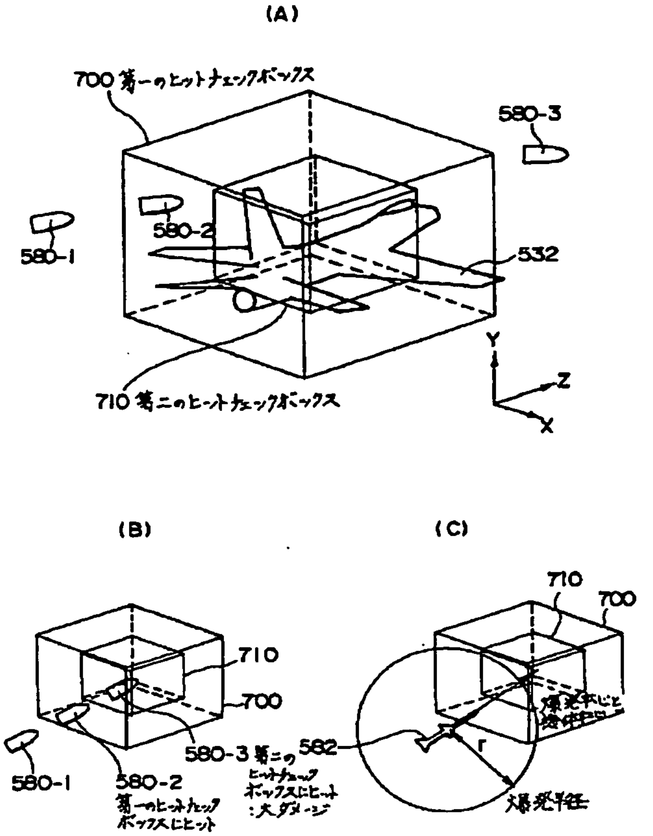
【図10】



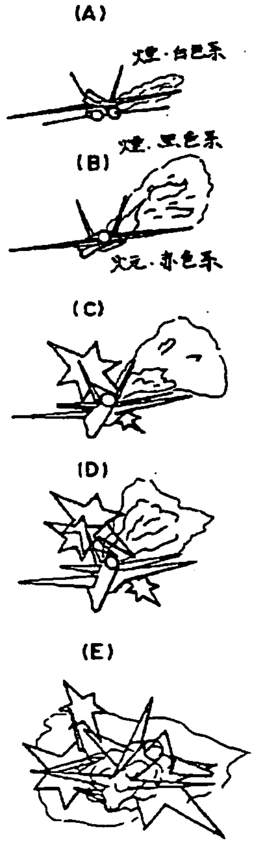
【図９】


300 ゲーム画面
330 残り時間
TIME
100
310a
532
322 ミサイルシーカー
324 ミサイルレンジサークル
320 バルカン砲照準
N
M0.75
3754m
ENEMYS:2
GUN: 2000
MSSL: 12
340 レーダー
350 攻撃アイテム

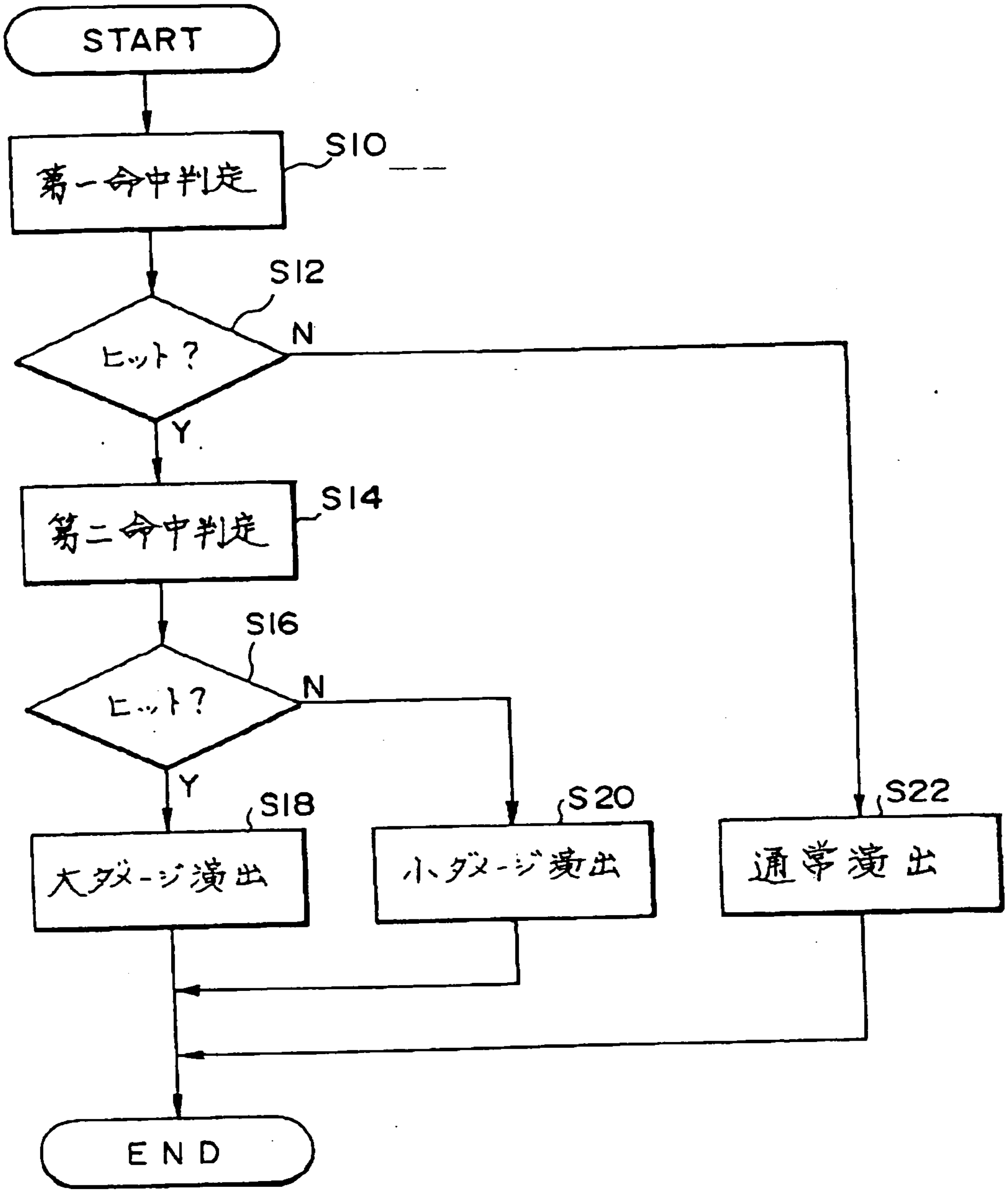
【図１２】


(A)
700 第一のヒットチェックボックス
580-3
580-2
580-1
532
710 第二のヒットチェックボックス
Y
Z
X
(B)
(C)
710
700
580-1
580-2 第一のヒットチェックボックスにヒット
580-3 第二のヒットチェックボックスにヒット：大ダメージ
582
r
爆発中心と機体中心
爆発半径

【図１４】


(A)
煙・白色系
(B)
煙・黒色系
炎・赤色系
(C)
(D)
(E)

【図１３】


START
第一命中判定
S10
ヒット？
S12
N
Y
第二命中判定
S14
ヒット？
S16
N
Y
大ダメージ演出
S18
小ダメージ演出
S20
通常演出
S22
END

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